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Louisiana Conservation REVIEW

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The Department Offers Projects Worthy of Federal Government's Undertaking as Permanent Benefit to Louisiana.

Published Quarterly by the
DEPARTMENT OF CONSERVATION

JANUARY
1934

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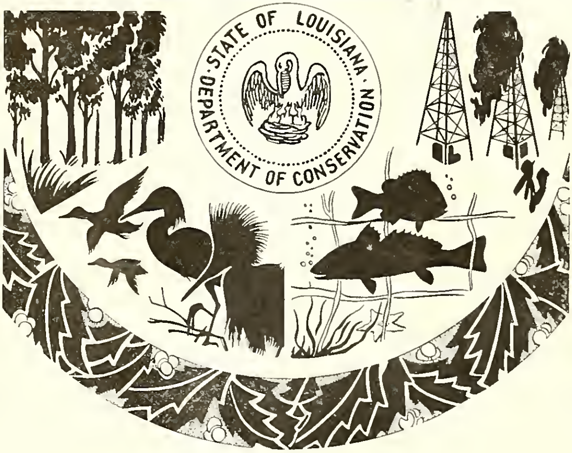


SEASON'S GREETINGS

In this season of "Peace on Earth," we pause to express to you the appreciation of this department for your aid and cooperation in inspiring the confidence and commendation of our people for labors in conserving nature's bountiful resources.

It is our sincere hope that the New Year will bring to you and yours a full and precious store of health and happiness.

Louisiana Department of Conservation
Robert S. Maestri
Commissioner.

152320

Commissioner Maestri's Four Years of Signal Conservation Service

Surpassing All Previous Records--Complete Reconstruction and Development of All Divisions of the Department

Some of the Outstanding Achievements of His Administration Follow:

ACCOUNTING AND ADMINISTRATION

The Department always remaining within its budget and carrying a substantial bank balance. At all times receiving the commendation of the State Supervisor of Public Accounts as evidenced by his comments:

> "And I was pleased to note that all disbursements were supported by good vouchers, and the accounts and records found in excellent shape."

Establishing a system of economy and saving and utilizing these savings in projects of permanent benefits.

Complete reconstruction of each Division and enlarging and broadening their activities which has required at least three-fourths more floor space than formerly maintained by the Department.

EDUCATION

The extension of the Bureau of Education with the services reaching every man, woman and child in the State.

The establishment of a State Conservation Museum which is the only state owned conservation museum in the United States in which is located an auditorium which offers daily picture and photofilm service free to the public.

The establishment of a Publicity Department which has published for the past three and one-half years a monthly and quarterly Review and substantial, educational and research bulletins.

Complete revision and compilation of all conservation laws which in itself is an outstanding work never before attempted or accomplished by former Commissioners.

ROBERT S. MAESTRI

ENFORCEMENT

In increasing the efficiency of the Patrol-Service, both on land and water. Reducing the general expense of this service at least one-third compared with past administrations. Placing Patrolmen at strategic points in the State. Assisting the sheriffs of the several Parishes and local game protectors and Federal agents.

FISHERIES

The establishment of fish hatcheries at an average cost of $25,000 each, and also fish and game preserves at an average cost of $75,000 each, spread over the State in naturally adapted locations.

FORESTRY

In a short period, the Division of Forestry, with the cooperation of the Federal Government and the landowners, has been able to reorganize the Division and make it one of the most efficient Forestry Bureaus in the Southern States.

MINERALS

The Division of Minerals has extended its activities and broadened its scope, not only in the oil and gas industry, but in all phases of industrial development which should bring to Louisiana many new industries, sulphur, etc. The establishment of a Minerals branch office in New Orleans, thereby coordinating the State's mineral activity with the present National Recovery Act.

OYSTERS AND WATER BOTTOMS

This division is responsible for the shell fish and water bottoms of the state, enforcing conservation regulations and collecting revenues due the state. It has extended its activities, both in the cultivated oyster fields and the exploitation of the natural reefs. It has applied an intensive system of supervision and control.

(Continued on Page 6)

The Prairie Falcon

By ALFRED M. BAILEY
and R. J. NIEDRACH
With Photographs by the Authors

"BIRDS of prey" were once common throughout North America, but owing to our unfortunate habit of considering capable and fearless species as destructive to the interests of man, they have been reduced in numbers. The hawks and eagles are birds of the chase; the majority of them catch and kill their food, but studies of their food habits have shown that there is little excuse for carrying on the warfare of extermination. One of the finest of all these fast flying birds is the prairie falcon, an inhabitant of the open and foothill regions of the West. He is a resident of the range country, and is well loved for his beauty and courage.

Memories take us back to the open region of northeastern Colorado, the extensive rolling prairie which is broken by a precipitous escarpment running down from Wyoming to cut off the upper corner of the State. It is spring, and great white clouds hurrying across the sky mass over the broken cliffs; mountain plovers rise from the short grass prairie and climb into the sky with slow, methodical strokes of their wings, and then float back to earth as they give their love song, while black-bellied McCown's longspurs go through a similar performance as though to show the plovers that they, too, can perform antics for the benefit of prospective mates.

A prairie dog village, with the diminutive inhabitants clustered upon the various mounds, stretches as far as the eye can reach, and a "whirling devil" — an infant cyclone — comes sweeping through the little settlement, sending dust and tumble weeds circling skyward. It is the peaceful time of the year in the West. All nature is awakening; green sprouts of grasses are appearing through the dead growth of the year before, the cactus is showing renewed life, and white fields of prairie primrose appear as splotches of snow across the broad expanse.

As we walk along the edge of the dog town, near the escarpment, a great-winged eagle sails out into space from a spot of shadow, where he had been resting unobserved, and flies leisurely along, and then while we admire the beauty of his flight we are attracted by a shrill scream of dis-

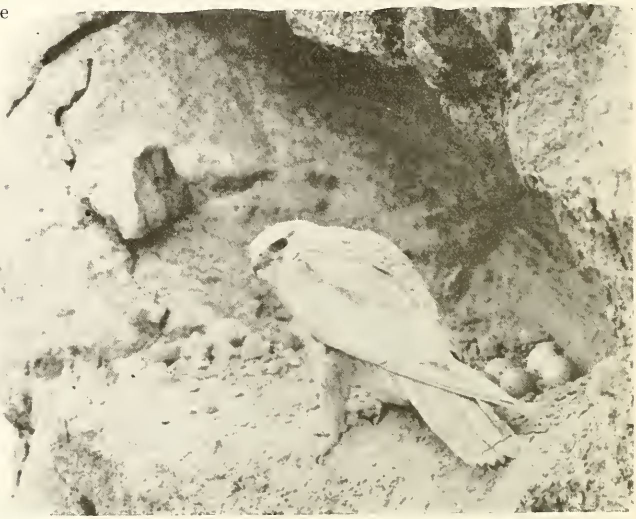
Here, where a precipitous escarpment breaks the great, rolling Colorado prairie, nest the birds of prey. Here the prairie falcon, bird of the chase and loved for his beauty and courage, makes his home.

Below, fields of white prairie primroses dot the landscape like drifts of snow.

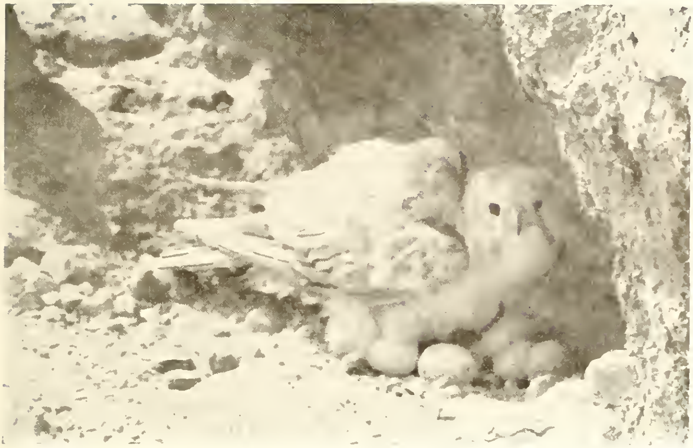
pleasure overhead, as a medium sized falcon darts with the speed of an arrow at the slow moving eagle. The latter's movement are no longer leisurely, however. He immediately puts on all speed, and with the unwelcome falcon swooping in vicious onslaughts from the rear, much as a small terrier would snap at the heels of a lion, the great bird makes an undignified and hurried exit from the vicinity. A few minutes later, we saw the falcon darting low over the homes of the prairie dogs. He dipped close to the earth and struck one of the rodents scurrying for cover, and, with scarcely slackening speed, mounted into the sky with a young prairie dog dangling from his talons. He circled higher, as though to look us over, and then flew to a pinnacle of rock where we could see him tearing at his prey.

One of us, Niedrach, had "worked" the region for many seasons, studying the various species of hawks which inhabit the cliffs, and a pair of falcons had nested for nine consecutive years in various places along the upright walls. The nests were always in such inaccessible places that it was necessary to reach them from above with the aid of a line, and we, with F. R. Dickinson, were now searching for the falcon's nest in the hope of securing motion films for our respective institutions, the Chicago Academy of Sciences and the Colorado Museum of Natural History. We had a photographer's tent, especially built over a framework of steel rods, which we expected to lower down the cliffs, and we hoped, if the birds were willing, to photograph their family life. It was one of those rare spring days in northeastern Colorado, when the winds blew gently, but the hurrying clouds warned us that we could expect the usual violent gale within a few hours. We climbed the face of the cliff along a water worn arroya, and worked from point to point, searching the face of the walls for a depression which might contain the nest. We felt reasonably sure that the brooding female must be somewhere near, as the male began to show signs of uneasiness. He left his perch to circle at a respectable distance, giving voice to his displeasure in shrill, plaintive cries. At the head of one of the little draws, a white-rumped shrike flushed from its coarsely woven nest in a low yellow pine, and the adult flew away, low over the ground, with a flash of black and gray wing. Lark sparrows were working busily upon the flats at the top of the cliffs, but as both sexes were present, we felt sure they were not nesting.

We walked along the summit of the escarpment, scanning the walls carefully with binoculars, but could not locate the nest. A half mile from where the male was first observed, however, we saw a massive nest of sticks appearing to hang suspended along a pinnacle of rock which projected into space, and crouched low upon it was a beautiful ferruginous rough-legged hawk. There was a broken place in the wall, which seemed to prom-



We found the falcon at home, reluctant to leave, for it was a crucial time in her home life. She paused on the edge of the rock shelf, eyeing us angrily, before diving off into space.



Eventually the beautiful white falcon sped straight back to the nesting platform. Though distrustful of the blind, she alighted and, apparently reassured that the glistening black lens of our camera was not an active enemy, settled down softly once more upon her eggs.

ise a chance of anchoring a blind, so we went on without flushing the bird, knowing that we had found something to work on if we failed to find our falcon.

After scanning the cliffs from above, we dropped to the base and worked back over the broken terrain; a small prairie rattler, sunning himself upon a warm ledge, coiled quickly, and started his buzzer working, and then, seeing that we were not going to approach closer, uncoiled and glided into a nearby crevice.

The escarpment was precipitous in this place, and directly above us there seemed to be a shelf with a few sticks projecting. It was not the home of our falcon, we knew, for they rarely line their nests, so a rock was thrown against the walls, as high as possible, and a few loud yells were given. There was a movement above and a great bird launched into space on outstretched wings. We had located the nesting place of a golden eagle, and we had another prospective photographic victim.

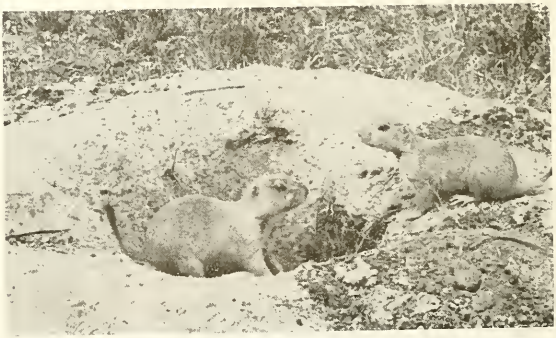
Our trail led us across the prairie dog village to the place where the falcon was first sighted. The male was still circling about, now just a speck in the blue, and again a fearless fellow on quivering wing that swooped within gun range time and again. There was one broken piece of cliff that seemed to offer possibilities; we had been unable to examine it from above, but a water worn crevice offered a scant foothold, and Bailey made the climb. Half way up he paused for breath, and over to his left, partially hidden by a projection, appeared a small hole. He took a little rock and threw it in the general direction. It struck the edge of the hollow—and out came the female falcon. And, what a bird! Niedrach had promised a surprise, but such a beautiful hawk was not expected. Instead of the natural brown plumage of the species, this bird was cream white, with occasional markings of the natural dark color. She hovered overhead, shrieking her displeasure at the invasion, and, even at that distance, her black eyes contrasted with her light-colored feathers. Niedrach has known that particular bird for nine years. She had nested in the vicinity each year, but he had never been able to reach her nest to photograph it, and, in that time, he had never seen other light-colored falcons, with the exception of one young bird, which had a white feather in the center of the back. Apparently, the young were usually of normal plumage. The nest located, all we had to do was to secure photographs of the bird upon her eggs.

On the broken terrain, sunning himself comfortably on a warm ledge, was a small prairie rattler.

The chances did not seem bright at first, but then we found we really were in luck, for on the other side of the nest was a ledge where the blind could be anchored on a place overlooking the cavity containing the five beautiful brownish eggs. It was not even necessary to use the swinging platform. It is true, there was a scant three feet for the photographer, blind and camera, but that was sufficient. The tent was put in place, anchored with rocks, and left, so the old falcon would be accustomed to it.

The wind began to blow that afternoon, as winds usually do in that part of Colorado, and we feared for our blind. Our fears were justified, for we visited the place in the evening and found the steel framework with the lashed canvas a quarter of a mile away, hopelessly smashed, at the base of the cliff. Fortunately, there was another blind—and also, fortunately, there was no photographer on the ledge when the wind began. With lines attached to projections on the cliff, and rocks placed upon the steel framework, we were able to make this tent more secure, and we departed hurriedly, hoping the old one would return to her eggs before they were hopelessly chilled.

Rain and snow swept the prairies for two days and we were unable to reach the cliffs, but bright weather came eventually. When we were within sight of the escarpment, we began to scan them with the glasses, to see if the blind was still in place. At last, it was sighted, in good shape. Now, if the old one had returned — about one chance in fifty—all was well.


The prairie dog villages are the hunting grounds of the falcon. Swooping low over their little homes, the predators grasp in their sharp talons their tender bits of prey.

The falcon was at at home and this time she was reluctant to leave, for she paused momentarily upon the edge of the shelf before diving into space. The reason was obvious. The near side of one of the eggs showed a small pip. By a stroke of luck we had hit upon the one time when a bird may be photographed, if at all, for few species will desert their hatching young. Birds which ordinarily will stay away for hours will return within comparatively short time. There was room for only one in the blind, and, after the camera was in place, with the lens aimed at the nest, the others left the vicinity, with the white falcon sailing around them, as though escorting them away. Then she sped straight for the nesting platform. With rapid strokes of her short wings she came head on, and with feet extended and wings back to alight, she espied the glistening black lens stuck from the canvas. Quickly she wheeled away with a cry of alarm, hurling invectives at the shining object. A piece of burlap was cut from the sack containing the spare film and fastened about the lens. And in a few minutes the hawk darted in and dropped to the ledge. She was nervous, however, and when the camera was started she dived headlong from her perch and joined the male on the cliff a few hundred yards away. She sat upright a long time, with the light shining on her breast, but after a while she assumed a horizontal position and then took off for her nest. The camera was started immediately and in a few moments she alighted, as before. Motionless, with wings dropped, she looked at the blind, and finally, apparently satisfied that all was well in spite of the whirring noise, settled down upon her eggs.

We returned to the blind the following day and found that two of the young were hatched, small downy fellows sprawled awkwardly on the rocky shelf. The mother came in within half an hour to shelter the babies and the remaining eggs. Film records were made, but a great dust cloud in the distance warned us of an approaching gale. Cameras were quickly lowered down the cliff, the photographer followed as rapidly as possible, and then the wind blew. The first onslaught lifted the blind from the shelf and sent it crashing away. We had photographed our white falcon. We had all the motion film we really needed, and we could head for home without regrets.

o

COMMISSIONER MAESTRI

(Continued from Page 2)

Scientific Research and Statistics

The establishment of a Bureau of Scientific Research and Statistics which has rendered marked service to the individual as well as to the State and Nation during the past three years.

The establishment of effective agency in controlling pollution and through this Bureau applying corrective methods and undertaking special study of marine mortality, bird mortality and mortality of fur-bearing animals and the life and habitat of the shrimp.

Wild Life

Vast improvement of the wild life preserve and sanctuaries covering some four hundred thousand acres, placing thereon all necessary protective agencies.

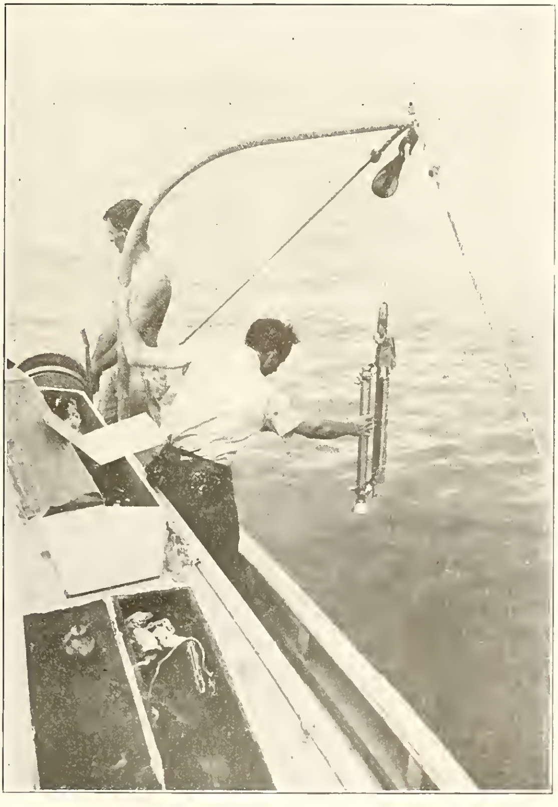
Adoption of proper regulations tending to stimulate and expand the fur industry of Louisiana.

Co-operative Shrimp Investigations Shed Important Light on South's Most Valuable Fishery

By
HU B. MYERS,
Director, Bureau of Scientific Research and Statistics
and
JAMES NELSON GOWANLOCH
Chief Biologist, Bureau of Scientific Research and Statistics, Department of Conservation

THE commercial catch of shrimp for the United States and Alaska ranked in 1931 (Fishery Industries of the United States, 1932) seventh in volume and sixth in value of all fishery products. A total of 99,432,000 pounds, with a value of $2,850,000, was marketed during that year. The total catch for Louisiana, during 1931, was 35,148,000 pounds, with a value of $844,000, while during the same period the catch for the State of Mississippi (a large part of which production was taken in Louisiana waters) was 17,716,000 pounds with a value of $394,000. The only United States fisheries exceeding shrimp in volume were, in descending order of magnitude, Salmon, Pilchard, Menhaden, Haddock, Sea Herring and Cod. The only fisheries exceeding shrimp in value were, in descending order of aggregate values, Salmon, Haddock, Lobsters, Clams and Halibut.

This total shrimp production has been modified by existing economic conditions and exhibits at present a presumably temporary decline from the high peak of the 1928 total for Louisiana alone, 53,779,000 pounds with a value of $2,159,000; for the Gulf States, 82,170,000 pounds with a value of $3,092,000; for the combined South Atlantic and Gulf States, 115,480,000 pounds with a value of $4,550,000. During that year it was the fifth fishery of the United States in order of value.



SECURING SEA TEMPERATURE RECORDS AND SEA WATER SAMPLES FOR CHEMICAL ANALYSIS

Suspended on a woven steel cable, the Greene-Bigelow water bottle is lowered into the sea to the desired depth and is "tripped" by dispatching along the cable the cylindrical "messenger" of solid metal which can be seen resting on the upper end of the apparatus. The impact of the "messenger" causes the two deep sea reversing thermometers to turn over, thus registering an accurate temperature record and, at the same instant, closes the water bottle portion of the apparatus (that part here held in the observer's hand) permitting subsequent analysis of an unchanged water sample from an exact depth.

It was therefore surprising in the light of the high economic value of the shrimp fishery to learn that of all commercially valuable marine animals, it remained apparently the least understood. Indeed it was not possible on the basis of available knowledge to sketch, even in broad terms, any valid and substantiated life history of the sea shrimp, although such knowledge of breeding place and breeding time was obviously essential for the framing of adequate conservation laws for this resource.

SHRIMP TRAWLERS AT WORK IN LOUISIANA

When the shrimp are numerous, considerable fleets of shrimp trawlers will be found at work within even a small area. The deckload of shrimp on the boat in the foreground can be seen just forward of the cabin.

RESULTS ALREADY ACCOMPLISHED

The following report will give, in summary, an account of certain of the results already accomplished by the cooperative shrimp investigations participated in by the Department of Conservation of Louisiana and the Bureau of Fisheries of the Federal Government together with, elsewhere, certain cooperative activities on the part of the State of Georgia and the State of Texas. It will further relate the steps by which the Department of Conservation entered upon this research program, the progress of which has yielded for the first time a knowledge of the major features of shrimp life history.

This report is an integral part of the Eleventh Bienniel Report of the Bureau of Scientific Research and Statistics.

The entire shrimp investigations constitute a closely integrated cooperative program between the States of Louisiana, Georgia and Texas and the Bureau of Fisheries of the Department of Commerce of the United States Government. The Department of Conservation of Louisiana contributed greatly more in support of the shrimp program than did the other two cooperating States, a logical state of affairs since the shrimp industry is preeminently centered in Louisiana waters. The headquarters for the shrimp investigation were also appropriately located in the laboratories of the Department of Conservation of the State of Louisiana at New Orleans.

The shrimp investigations herein discussed have already accomplished the following results:

1. For the first time there has been collected a coherent mass of original data which provides the basis for an understanding of the major features of the shrimp life history and offers the first available answer to the questions: How long does the shrimp live? When and where does spawning occur? Where do the young occur in early stages?

2. It has provided for the first time the systematic collection of hydrographic data in Louisiana waters. Hitherto the only hydrographic studies made in Louisiana waters have been either extremely fragmentary in character or, if systematic, were extended over only a brief period of time. It must be appreciated that this hydrographic information is of value not only in relation to the shrimp fishery but also in relation to the study of all other marine resources of the state.

3. It has resulted in the inauguration in the State of Louisiana of a completely new system of reporting shrimp production, which, it is hoped, will become adequate for statistical returns cov-

SORTING A SHRIMP HAUL ABOARD THE RESEARCH VESSEL "BLACK MALLARD"

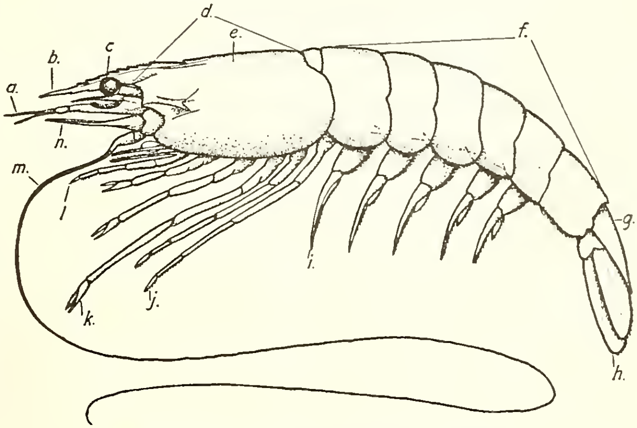
The first step in the study of the catch is the separation of the shrimp and the sorting of all other animals, fishes, crabs, etc., into their respective groups. A record is kept of every animal in the shrimp haul and thereafter measurements of a "random sample" of at least two hundred individuals of the Sea Shrimp are carefully made.

ering the commercial shrimp catch. Ordinary records of production are of little or no value as scientific material as they do not contain the details necessary to permit of their analysis in terms of productive effort. This necessity is explained at some length elsewhere in this report.

Initiation of State and Federal Cooperative Program

It is desirable to state, in some detail, the circumstances under which the Department of Conservation of the State of Louisiana entered into cooperation with the Bureau of Fisheries of the Department of Commerce of the Federal Government in the initiation and conduct of the investigation of commercially important marine shrimp. This economic resource, the shrimp fishery, had, in spite of its great importance, no available foundation of ascertained facts concerning the life history, the breeding and the movements of the animals upon which it depended for very existence. Thus, there existed no adequate store of knowledge upon which to predicate proper and adequate control, so designed that it would safeguard the continued supply of the natural raw materials which are the basis of this industry. By Act No. 45 of 1930, the Legislature of the State of Louisiana brought into existence the Bureau of Scientific Research and Statistics, as a Division of the Department of Conservation, the first duties of which were to cooperate in the shrimp investigations.

Although Section 11 of the Act creating the Research Bureau stated that some $50,000.00 was to be appropriated for the fiscal year ending June 30th, 1931, and for a similar sum for the fiscal year ending June 30th, 1932, and although this appropriation was renewed by legislation at the session of the Legislature in June, 1932, as a matter of fact such appropriations were not made as direct sums but were contingent upon the surplus earnings of the Department of Conservation. The indefinite character of these earnings made necessary special action on the part of the Department of Conservation and compelled the Department to provide the funds necessary for the operation of the Bureau of Research from funds which were not otherwise allocated. The expenditures of the Bureau of Research have never approximated the limit provided by the legislation and in fact the total expended monies have been far from approaching the figure of $50,000.00 per annum.



THE COMMON SHRIMP, PENAEUS SETIFERUS (LINNAEUS).
(From Weymouth, Lindner and Anderson, 1933).

The more conspicuous structures are labeled as follows: a, antennule; b, rostrum or "spine"; c, eye; d, cephalothorax or "head"; e, carapace or "head shell"; f, abdomen or "tail"; g, telson or "tail spine"; h, uropod or "tail fin"; i, first pleopod or "swimming leg"; j, fifth pereiopod or "walking leg"; k, chela or "pincer" of third pereiopod; l, third maxilliped; m, antenna or "whisker"; n, antennal scale or acicle.

As a matter of fact the total expenditures of the Bureau of Scientific Research and Statistics, covering all its activities including participation in the shrimp investigations, have been as follows: March 26-June 30, 1931, $9,465.74; July 1, 1931-June 30, 1932, $17,155.62; July 1, 1932-June 30, 1933, $14,003.34; July 1, 1933-November 29, 1933, $6,796.28.

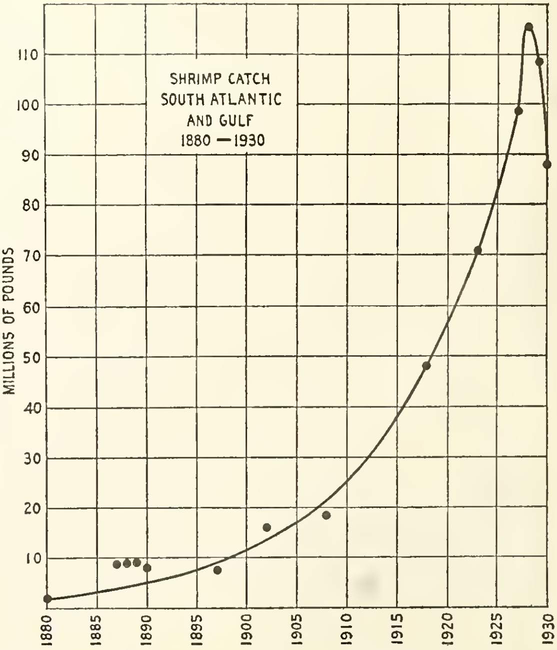
The legislation creating the Bureau of Research indicated wide potential fields of work for this new division including, indeed, the scientific study of Louisiana's fisheries, both fresh water and salt water, shrimp, oysters, fur-bearing animals, forestry products, mineral products and other natural resources.

However, there was a specific instruction in the Act that the new Bureau should, as one of its first tasks, investigate the Louisiana sea shrimp. This is stated as follows:

"Section 6. As the life habits of the sea shrimp have never been studied even by the Bureau of Fisheries of the United States of America, as affecting those sea shrimp in the waters of the Atlantic Ocean and the Gulf of Mexico, and the bays, bayous, lakes, tributary thereto; and as a serious difference of opinion exists among those engaged in the sea shrimp industry, as to whether the time when, the places where, the manner and methods and the means with which the sea shrimp are being presently taken are proper and calculated to insure a continuity of supply, or an eventual extermination of this natural resource, the Commissioner of Conservation is directed to cause to be begun at once a scientific study by a competent biologist or biologists of the life habits of these sea shrimp, and to secure and compile all statistical data possible so that at the earliest moment possible a report may be made by such biologist or biologists to the director of the Fisheries Division of the Department of Conservation to be submitted by him to the Commissioner of Conservation with his recommendations and to be acted upon in due course by the Commissioner of Conservation in accordance with the provisions of Section 5 of this Act, in so far as he may be able to so do under existing statutory law; but as the purpose of this Act, through the Bureau of Scientific Research and Statistics, is to create a fact-finding division of the Department of Conservation to advise the Commissioner of Conservation in technical matters affecting the natural resources under his control, if any finding of fact, approved by the Commissioner of Conservation, involves the necessity of legal regulation in the time, place, conditions, manner, means or methods of reducing the possession and/or of commercially utilizing any natural resource, the Commissioner of Conservation is hereby authorized, directed and required to submit through the Governor of the State in the form of a proposed legislative act for consideration at the next legislative session, the recommendations approved by him, in the manner hereinabove provided so that the Legislature of the State of Louisiana, in accordance with Sections one and two of Article VI of the Constitution of the State of Louisiana, may enact such recommendations into statutory law, if it desires so to do."

The field work in Louisiana, under the cooperative program, first began on March 10th, 1931, when scientists of the Bureau of Research, together with the scientists of the Bureau of Fisheries of the Federal Government, made an initial trip on the "Royal Tern", one of the enforcement vessels of the Department of Conservation. A preliminary ten day survey covered those regions of Louisiana's shrimping grounds from Main Pass to Grand Isle.

It was part of the cooperative project of State and Federal Governments that a vessel suitable for carrying out the systematic collection and study of materials be provided by the Bureau of Fisheries of the Department of Commerce of the Federal Government, while the responsibility for the necessary rebuilding, refitting and maintenance of this vessel, and of the crew therefor, be assumed by the Department of Conservation. Realizing that there would be an inevitable delay in finding a suitable craft, the Department of Conservation took steps to make possible an immediate commencement upon the research work. A sixty-three foot oyster lugger, the "Champion", was chartered by the Department of Conservation for the months of May to August, inclusive, and this vessel was immediately fitted with the equipment necessary for experimental shrimp trawling, water sampling, temperature studies and other research activities. Such equipment was subsequently transferred, without loss of expenditure, to the new research boat. The field work in which the "Champion" was used was begun May 19th, 1931, and as a result of information already secured, Grand Isle was chosen as the logical base for field studies. A wide, regular program of shrimp trawling, tow nettings, shrimp measurements, studies of water temperatures, chemical tests of the water and hydrographic observations of other kinds, was systematically carried



Growth of the Shrimp Catch for the South Atlantic and Gulf States Over a Period of Fifty Years—1880 to 1930.
(From Weymouth, Lindner and Anderson, 1933).

out, the researches extending from as far east as Bay St. Louis to as far west as Timbalier. Included also were several exploratory offshore trips extending as far as one hundred and thirty-five miles out into the Gulf of Mexico.

The search for a suitable vessel for use as the permanent research boat resulted in the selection of a fifty-seven foot craft having a fourteen and one-half foot beam and a draft of four and one-half feet. This boat is driven by a one hundred and fifty horsepower gasoline motor. The responsibility for and the cost of rebuilding this boat to conform with the needs of the new work were undertaken by the Department of Conservation and the remodeling was completed under the direction of Captain Phillip Gehlbach, Superintendent of the Flotilla of the Department of Conservation. First named "Cormorant", the name of the boat was later changed to "Black Mallard" which designation it now bears.

Personnel of Cooperative Shrimp Investigations

The personnel of the cooperative shrimp investigations has undergone various changes during the progress of these studies. The Bureau of Research has been represented in these investigations by Colonel Hu B. Myers, Director of the Bureau of Scientific Research and Statistics, J. N. Gowanloch, Chief Biologist of the Bureau, and Forrest Durand, Assistant Biologist of the Bureau. Charles H. Neathery has been concerned with the collection of shrimp statistics under the new system of returns inaugurated as a result of these investigations. Martin D. Burkenroad and William Clark were each associated with the shrimp program for a period of several months. During certain periods of the conduct of this work the State of Louisiana also engaged the services of Miss Irene Reis and Mr. Anthony Capoza. Their work was concerned with the compilation of measurement data of the shrimp investigations. Mrs. B. D. Wood has served throughout the investigations as secretary for the entire project with the exception of one interim during which Mrs. Hattie Ratigan performed these duties. The "Black Mallard", research vessel provided by the Federal Government and completely rebuilt, refitted, maintained and manned by the Department of Conservation of the State of Louisiana, has as its present crew Captain Wm. E. Burgess, Ellis Loga, engineer, and Julius Smythe, steward. During the progress of the work, because of departmental shifts in boat command, the following have served as captains in charge of the research boat: Julius Book, Louis Cabirac and Geo. Adams. Throughout most of the time covered Henry Bruning served as engineer and Henry Denapolis as steward on the vessel.

The Federal group of investigators, representing the Bureau of Fisheries, was headed by Dr. Frank W. Weymouth, Professor of Physiology at Leland Stanford University, Palo Alto, California, as Director-in-Charge. Dr. Weymouth, because of academic duties, was unable to engage continuously in the work but during the intermittent periods of his absence maintained close contact with the progress of the studies. Milton J. Lindner served as Acting-in-Charge of the federal group in the absence of Dr. Weymouth and participated continuously in the direction and supervision of the Federal workers in North Carolina, Georgia and Texas. Gordon Gunter served as one of the Federal workers in Louisiana while W. W. Anderson, at Brunswick, Georgia, Dr. J. S. Gutsell, at Beaufort, North Carolina, and Kenneth H. Mosher, at Aransas Pass, Texas, were the Federal investigators in these respective states. Additionally there is maintained in Georgia a sea-going vessel engaged exclusively in the shrimp investigations and manned by its crew of two. John C. Pearson is the most recent member to join the Federal group working in Louisiana.

A comprehensive progress report on the shrimp investigations was published in October, 1933, by our co-workers in the shrimp investigations, Dr. F. W. Weymouth, Milton J. Lindner and W. W. Anderson under the title, "Preliminary Report on the Life History of the Common Shrimp, *Penaeus setiferus* (Linnaeus)", Bureau of Fisheries Bulletin, Volume XLVIII, Bulletin No. 14, pages 1 to 26, 11 figures. There is included in that paper a compact summary of much of the data already secured and a statement of the conclusions based upon these data. Most of the scientific data and conclusions given in this present report have been taken from that paper.

Shrimp Species Commercially Utilized

Several species of shrimp are commercially utilized in Louisiana, one alone of which provides the chief bulk of the fishery. The commercial shrimp of Louisiana belong to two different groups. The first is the so-called River Shrimp, *Macrobrachium* sp., which is a fresh water species although it invades brackish water under certain conditions. Several species of River Shrimp have been reported for southern waters, as Schmitt has stated in a recent survey of this group.

The River Shrimp do not form an extensive fishery and are not used in any canning process, being marketed entirely in a fresh condition.

The sea shrimp which form the important shrimp fishery are three closely related species which, however, contribute in very different degrees to making up the commercial catch. These three species are the Common Shrimp or Lake Shrimp, *Penaeus setiferus*, the Grooved Shrimp, *Penaeus brasiliensis*, and the Sea Bob, *Xiphopenaeus kroyeri*. The first named of these species is the chief basis for the shrimp industry in the South.

All three species are closely related, the Sea Bob differing from the other two in having a rostrum that equals or even exceeds the length of the carapace (the "head shell" of the shrimp). Additionally, the Sea Bob possesses greatly elongated fourth and fifth pairs of walking legs which because of their slenderness and the way in which they extend forward with the animal's long antenna have caused the French fishermen to give them the popular name of Six Beards (Six Barbes). This name has become corrupted into the now generally applied Sea Bob.

The Common Shrimp and the Grooved Shrimp are much larger than the Sea Bob and may be distinguished from the latter by the short rostrum and the absence of especially elongated fourth and fifth pairs of walking legs. The Grooved Shrimp can be readily distinguished from the Common Sea Shrimp, which it very closely resembles in appearance, by the backward extension of the rostral grooves. In the Common Sea Shrimp these grooves lying on each side of the dorsal midline of the carapace extend backward only about two-fifths of the total carapace length while in the Grooved Shrimp they extend backward about nine-tenths of the total carapace length.

Sea Shrimp present a highly specialized structural adaptation to their mode of life, remarkable at first glance for the extraordinary development of the antennae, and the differentiated structure of the various other appendages.

The Common Shrimp, *Penaeus setiferus*, the Grooved Shrimp, *Penaeus brasiliensis*, and the Sea Bob, *Xiphopenaeus kroyeri*, constitute the basis of the most important fishery in the South and one of the most important fisheries in the entire United States both in volume and value of catch. This sea food, marketed in the fresh condition, processed by various canning methods or dried in the sun after preliminary boiling, is used not only in Louisiana but is exported throughout the country and abroad.

CHANGES IN FISHING METHODS

The shrimp fishery was first pursued by primitive methods, the animals being captured by a "cast net," an ingeniously constructed device which, spun expertly by the operator, is flung through the air in the spread condition, sinks in the water and, upon the traction of the single retaining line, is pursed into a bag thus enclosing those shrimp and fish which have not had the swiftness to escape. This method, the use of the cast net, was evidently profitable in the early days (fifty years ago) of the shrimp fishery in the Gulf of Mexico. Organized fishing for shrimp next developed the seining method in which immense seines, manned by crews of as many as twenty-five men, are set to surround schools of shrimp and, skillfully managed, are hauled ashore, effecting, under favorable conditions, enormous catches.

Seining in turn gave way to a new and more adaptable shrimp fishing method, that of otter trawling. Here the net, consisting of two winglike walls and a terminal bag, is dragged through the water by a motored boat and is so provided with kited otter boards that the resultant of the various forces of motion through the water, strain on the boards and passage of the water through the net, tends to maintain this catching device in a spread condition on the sea bottom. The catch, secured by the tows of varying duration, depending on the abundance of shrimp, is hauled aboard, sorted, the "trash" fish and other animals are separated and are discarded overboard, and the shrimp are then either simply piled on deck until taken to the factory or drying platform or sold to "ice boats", or, dependent upon the type of boat, iced down in the hold of the boat from which they were caught.

HISTORICAL SURVEY

Sea Shrimp, until the present investigation was cooperatively begun by the States of Louisiana, Texas, Georgia and the Bureau of Fisheries of the Federal Government, were remarkable in being, as far as their life history is concerned, the least understood of all economic marine animals. No clear evidence was available concerning the spawning, the movements, the growth and the duration of life of these valuable animals. A larval stage of shrimp, the nauplius, presumed to be referable to *Penaeus*, had been reported from Brazil by Fritz Muller in 1863. Dr. W. K. Brooks of Johns Hopkins University published, in 1883, studies of stages of young shrimp which he had collected at Beaufort, North Carolina. He was able in his work to trace the main stages of early shrimp life history through the larval period and he assumed that these were penaeids. He did not know to which species they belonged. Spaulding and Guilbeau, in 1908, and Gates, in 1910, published reports based on the work conducted at the Gulf Biologic Station at Cameron, Louisiana.

CONDUCT OF THE WORK

Laymen unfamiliar with the methods of conducting such scientific field studies may be interested in a brief description of the procedures. Research trips, lasting from six to twelve days, are made systematically to carefully chosen significant shrimp fishing areas. The vessel, in addition to her operating crew of three, carries on each of these trips from two to four scientific workers. Equipped with trawling gear of commercial specifications, the research boat performs shrimp trawling at definite "stations", i. e., selected localities where by repeated collections the seasonal or other changes in the character of the shrimp population can be ascertained. The trawl catch is then carefully sorted, the shrimp separated in their several species and their volume measured. The fishes and incidental invertebrate animals occurring in the catch are sorted, counted and recorded. These details of "trash" fish, while of no interest to the shrimp fishermen are of high conservation value since they provide a measure of any destruction of sport and commercial fish species which shrimp trawling may cause.

The shrimp catch itself is then analyzed in detail by the following standard "random sampling" method.

"Random sampling" is a device to secure an accurately representative sample of a given population. It is inevitable that an observer who is picking out a group of individuals for measurement will unconsciously exercise some selection in his choice of animals and will thus modify the results. By the procedure practiced in "random sampling", one or two buckets of shrimp are taken without any selection at all simply by filling the container with a mass of shrimp from the catch. Experience enables the investigator to judge quite closely the mass of shrimp that will contain the desired number. Should they prove to be too few the necessary additional shrimp are simply taken blindly, without selection, from the catch. This sample thus represents a purely fortuitous group unaffected by the natural tendency toward selection which would enter into the sampling if, instead of following this procedure, the investigator were to pick one by one from the whole pile the two hundred shrimp he desired to examine.

It is necessary also in studying the numbers and movements of shrimp to learn accurately the conditions of the water at the time the shrimp haul is secured. Factors which may influence shrimp movements thus become systematically available. Such factors are the temperature, the salinity, the turbidity and the hydrogen-ion concentration of the water, the force and direction of wind, and the character of general light. Since both water temperatures and water salinities may differ at the top and bottom of even relatively shallow sea areas it is necessary for accurate work to use some device that will register in a reliable manner the temperature at a given position and time and will simultaneously collect a sample of the water from the same position. Various hydrographic devices are available for this purpose, and in this shrimp investigation choice was made of the Greene-Bigelow water bottle and reversing thermometer case. This scientific instrument, of which an illustration is given elsewhere, is so designed that when lowered at the end of a wire cable to any depth it sensitively responds to the temperature and contains, at any given moment, an accurate sample of the water in which it is suspended. When the observer wishes to secure a record, a metal cylinder, termed a "messenger", is released, runs down the wire cable and upon its impact the Greene-Bigelow water bottle is actuated in such a manner that it completely closes, thus securing a water sample and, at the same instant, the ingeniously devised Negretti-Zambra thermometers are reversed in position, their mercury columns are interrupted and as long as they remain in this inverted position they are insensitive to temperature changes and thus record with accuracy the temperature registered at the moment the water bottle was "tripped". Such water samples are preserved in four ounce bottles sealed with especially prepared corks and are subsequently analyzed by the Mohr silver nitrate titration method to determine their salinity. These titration results are evaluated by comparison with control titration of standard water imported from the internationally established Laboratoire Hydrographique at Copenhagen, Denmark.

METHOD OF SHRIMP MEASUREMENT

In the measurement of the shrimp the total length is taken from the tip of the rostrum (the forwardly projecting structure termed by the fishermen the "spine" or "spear") to the end of the telson (the centrally placed element of the tail fin). Further studies directed to the detection of differentiated local groups of shrimp involved the measurement of certain other dimensions of the shrimp such as rostral length, carapace, length and variation in number of spines on both the upper and lower rostral surface.

Total measurements are secured by the use of a standard shrimp measuring board upon which the animal is placed ventral surface down, the anterior tip of the rostrum is placed in contact with the vertical end plate of the measuring board and the measurement recorded to the nearest millimeter (1/25 of an inch). Handling of the data is facilitated by separating the total length measurements into five millimeter (1/5 of an inch) groups. The middle point for these groups was arbitrarily selected at the three and the eight measurement figures so that in this way, for example, shrimp measuring 131 to 135 millimeters, inclusive, would fall in one group whose mid-point was 133 millimeters and shrimp measuring 136 to 140 millimeters would form the consecutive group with its mid-point at 138 millimeters. Data so segregated afford much more rapid treatment in analysis and graphing. The measurements of the individual shrimp are always carried out while the animals are in the fresh condition and the whole procedure is so standardized that the results are properly comparable. The amount of time necessarily spent in securing the measurements themselves in the field, in subsequently tabulating such measurements in groups and thereafter computing and plotting the averages as the means of providing these data so essential for the studies of growth rate, seasonal size characteristics and sexual size differentiations, may be appreciated when it is realized that over 170,000 shrimp were measured and analyzed under this procedure. The following table gives in summary the totals, for only part of the period, of individual shrimp measured, segregated according to semi-monthly groups, states and sex:

Period	Georgia		Louisiana		Texas	
	Males	Females	Males	Females	Males	Females
1931						
Feb., first half	547	638	....	....	....	....
Feb., second half	1,024	1,111	....	....	....	....
Mar., first half	476	563	....	....	....	....
Mar., second half	559	627	....	....	....	....
Apr., first half	819	830	....	....	....	....
Apr., second half	732	821	....	....	....	....
May, first half	1,222	1,314	....	....	....	....
May, second half	1,012	1,287	155	139	495	536
June, first half	604	1,010	....	....	575	525
June, second half	81	411	37	50	311	289
July, first half	453	411	....	....	494	506
July, second half	427	373	530	476	69	131
Aug., first half	918	521	969	788	222	178
Aug., second half	1,730	1,398	964	889	433	367
Sept., first half	1,551	1,467	1,996	2,004	315	310
Sept., second half	1,552	1,720	1,972	2,028	488	512
Oct., first half	664	752	1,151	1,308	598	602
Oct., second half	1,329	1,389	1,339	1,261	588	612
Nov., first half	632	679	1,994	2,206	394	406
Nov., second half	1,158	1,323	319	362	463	537
Dec., first half	1,737	1,862	349	451	439	561
Dec., second half	....	....	....	....	348	452
Subtotal	19,227	20,507	11,775	11,962	6,232	6,524

Period	Georgia		Louisiana		Texas	
	Males	Females	Males	Females	Males	Females
1932						
Jan., first half	456	528	328	317	178	222
Jan., second half	476	561	....	....	172	228
Feb., first half	301	343	....	....	777	823
Feb., second half	275	338	....	....	193	207
Mar., first half	507	514	485	607	291	309
Mar., second half	457	526	361	378	186	214
Apr, first half	1,260	1,322	272	265	420	480
Apr., second half	1,348	1,592	126	82	101	99
May, first half	125	212	326	285	118	282
May, second half	662	931	233	248	393	407
June, first half	349	596	73	49	177	223
June, second half	314	688	248	290	101	99
July, first half	373	356	237	270	314	286
July, second half	963	683	255	287	306	294
Aug., first half	1,017	704	217	204	792	608
Total	28,110	30,401	14,936	15,244	10,751	11,305

HABITS OF THE SEA SHRIMP

It is difficult to make direct observations of the movements and behavior of shrimp in nature due to the heavily silted character of the waters they inhabit. Shrimp movements are notoriously erratic as has been observed by all shrimp fishermen. Surface schooling appears to be infrequent although it occurs. Shrimp are obviously capable of rapid and extensive movements. The ordinary swimming is accomplished by the concerted movements of the abdominal legs (the pleopods). Short sudden swift movements are produced by rapid contraction of the abdominal muscles bringing the broad tail fin downward and forward. The shrimp, by this means, leaps suddenly backward, from which motion is derived the Louisiana-French name for this animal, *Chevrette*, "little kid".

The food habits of shrimp are evidently subject to wide variation. The operation of the digestive apparatus in the shrimp is such that food in the alimentary tract is found only in a highly comminuted state. Identification of constituent materials is therefore rendered difficult but there is revealed the presence of both plant and animal tissues. In addition, it is quite apparent that the shrimp ingest great quantities of bottom material some of which, because of its organic nature, may contribute appreciably, when subjected to digestive action, to the nutrition of the animal. Shrimp, when held in an aquarium, will be found to devour animal tissues such as oyster muscle or fish muscle readily, and will further be found to attack and destroy living fishes which are small enough for them to handle. Similarly they have been observed, when confined in aquaria, to attack, kill and eat individuals of their own species which are smaller than themselves. Fishes, encompassed by the shrimp's appendages, are quickly killed and eaten. The evidence available indicates that shrimp are not only predacious but are evidently almost omnivorous in their feeding habits. Among the identified tissues noted in the alimentary tract of the shrimp are worms of various kinds, various crustacea (including shrimps themselves), mollusks and various shell fish.

Sea shrimp differ from other commercially important American crustacea, such as the Blue Crab (*Callinectes sapidus*) and the American lobster (*Homarus americanus*), in that they do not, as in the case of the latter animals, carry about their developing eggs attached to the adult female after fertilization. This difference in habit adds to the difficulties involved in studying the early stages. The eggs of the sea shrimp, produced in large numbers, are evidently cast into the sea, probably immediately after fertilization and undergo their subsequent development through a series of six or eight larval stages while drifting in the water. They thus constitute elements in the plankton, the name given by biologists to all those sea animals and sea plants which, possessed either of no, or of but feeble, powers of locomotion, drift at the impulse of tides and currents.

Spawning of the sea shrimp in Louisiana extends through a long period of the year, from March or April through to August or September.

The spermatozoa are aggregated in the reproductive organs of the male to form a compact structure termed the spermatophore. This is transferred, it appears evident, by means of a specially modified pair of appendages formed of the inner rami of the first pair of pleopods; the resulting structure is termed the petasma or andricum. Covered with a glutinous material, this spermatophore, after it is transferred to the female, becomes attached in the region between the third and fourth pairs of periopods on the under surface of the female and in this position evidently is carried briefly during the fertilization of the eggs. Spermatophores are remarkably rare, which may possibly be explained by the fact that they are fairly easily separable from their attachment. During the course of these investigations a total of only twenty spermatophores has been found in a total of 18,487 females examined during those months when breeding occurs. The distribution of these and the percentage of females examined which exhibit the presence of spermatophores are as follows:

Louisiana, 3,561 females, 7 with spermatophores present representing 0.2%.

Georgia, 11,015 females, 3 with spermatophores present representing 0.7%.

Texas, 3,911 females, 10 with spermatophores present representing 0.26%.

The ovaries of all females found bearing spermatophores showed upon examination the ripest degree of development. The length of these females averaging 166.3 millimeters (a little over 6½ inches) ranged from 141 millimeters (a little over 5½ inches) to 186 millimeters (a little under 7½ inches), thus coinciding with the length measurements of the females in the general population displaying the highest degree of ovary development.

The presence of spermatophores and the maturity characteristics of the ovaries of the females are not the only available evidence of the ripeness of the shrimp for breeding since it is quite possible to trace in the males the stages of development and maturity of the spermatophores. The developed spermatophore can be easily recognized and readily artificially pressed from the lower end of the reproductive ducts (the vasa deferentia) of the males. Spermatophore maturity in the males appears slightly earlier, extends through and roughly coincides with the end of the period of sexual maturity in the females evidenced by ovary condition. This additional evidence of ripeness for breeding on the part of the males thus fully substantiates the time and length of the breeding season already indicated by the ovarian data of the females.

GROWTH CHANGES FROM MEASUREMENT STUDIES

The soundest available approach to the solution of the problem of the age of the shrimp—a problem of great importance in the control of the commercial fishery—is therefore an analysis of the shrimp population throughout the year. This analysis is accomplished by measuring "random samples" taken in experimental shrimp trawling at the chosen places at appropriate intervals throughout the entire year. Such data have been gathered in Louisiana, in Texas and in Georgia. It so happens that the Georgia measurements constitute a longer and less interrupted series than do those of either of the other states and for this reason therefore these figures are used instead of the measurements made in Louisiana. Careful comparison of the Georgia, the Louisiana and the Texas results indicate a general and comparatively close uniformity, clearly indicating that the growth and size characteristics of the population of commercial shrimp are essentially alike in Georgia, in Louisiana and in Texas. The Georgia figures, analyzed by Weymouth, Lindner, and Anderson aggregated 58,521 shrimp measurements grouped into half monthly time periods beginning February 1st, 1931, and ending August 15th, 1932. These measurements, obtained by a standard practice which has been described above, are divided into male and female groups and plotted in the form of graphs thus indicating at a glance the size frequency of the commercial shrimp population at a given time.

The results may be briefly described as follows:

February 1st to 15th, 1931, the shrimp population shows a conformity in size of both males and females with the greatest number of individuals slightly over 100 millimeters (4 inches) in length. A second group, slightly over 140 millimeters (5 3/5 inches) in length is indicated.

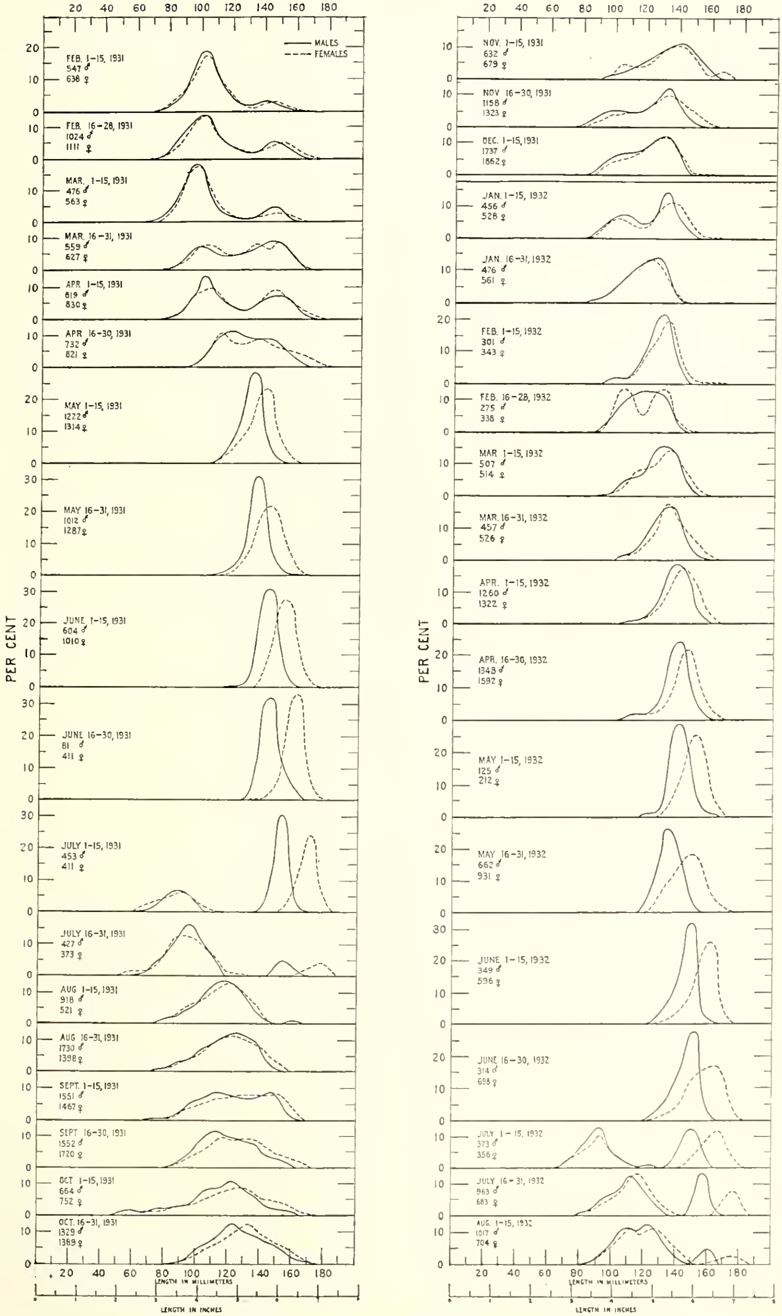
The period of February 16th to 28th, 1931, shows a broadening of the curve and a more pronounced indication of the second and larger group.

The subsequent history may be roughly described as follows:

The group centering about 100 millimeters (4 inches) in length apparently feeds into the high group; in other words, the first described group becomes less, the second group greater, until in the April 16th to 30th period the two have merged with the greatest number of individuals measuring 110 to 150 millimeters (4 2/5 to 6 inches) in length. In the period of May 1st to 15th, 1931, the shrimp population has resolved itself into two symmetrical smooth single peaked curves, one of the males with the greatest number measuring 130 millimeters (5 1/5 inches) in length, the other, females, the greatest number measuring 140 millimeters (5 3/5 inches) in length. This characteristic of the population continues up to and including the period June 15th to 30th with only the shift of these curves to the right as the population increases in size. During the period June 16th to 30th, the peak of the male population has reached 150 millimeters (6 inches), of the female population, 170 millimeters (6 4/5 inches). In the period July 15th to 31st, a new group of shrimp has appeared in the catch, both males and females of which center about 90 millimeters (3 3/5 inches) in length, whereas at the same time the majority of the shrimp form two curves, the males with their greatest frequency somewhat under 160 millimeters (6 2/5 inches) in length, the females with their greatest frequency somewhat under 180 millimeters (7 1/5 inches) in length. The period of July 16th to 31st shows the sharp reduction in numbers of this upper group of population although the size remains about the same. At the same time the smaller group of shrimp have sharply increased in numbers and have begun to increase in size so that now forming the major part of the shrimp population both males and females center around a length of slightly over 100 millimeters (4 inches). During the period August 15th to 31st, 1931, this upper group of shrimp, the older shrimp, have almost disappeared from the population while the great bulk of shrimp population now forms a broad curve. Thereafter there is a steady growth until the group of July 15th to 31st, 1931, centered around 95 millimeters (3 4/5 inches), attains by the period of November 1st to 15th, 1931, a center around 145 millimeters (5 4/5 inches). The continued growth through the subsequent months develops by the period May 1st to 15th, 1932, a size differentiation closely similar with that shown a year earlier in the period of May 1st to 15th, 1931. Steady growth continues and by July 1st to 15th, 1932, there is again, as in July 1st to 15th, 1931, the appearance of a large group of shrimp whose size frequency centers around 90 millimeters (3 3/5 inches), for both males and females, in sharp contrast with the group of larger shrimp whose size frequency centers for the males around 150 millimeters (6 inches), for the females around 175 millimeters (7 inches). Thus, there is clearly shown a progressive seasonal change in the characteristics of the shrimp population, one group steadily increasing in size and decreasing in numbers while in the first half of the month of July a second group enters the commercial catch and, increasing in both numbers and size, steadily supplants the larger shrimp which correspondingly decrease in numbers.

Dangers of Short Life-span

The results of the present shrimp investigations provide for the first time evidence which makes possible an understanding of the major features of shrimp life history. Spawning occurs in Louisiana from late March or April through August or September and takes place in the sea in water of high salinity. The evidence for this is derived both from the condition of the ovaries and testes of the adults and from the presence of attached spermatophores on the females. Further details of these fields of evidence are given elsewhere. It is clear that spawning occurs in water of high salinity. The young, after passing through a complicated series of some eight or ten stages, evidently migrate landward and are found in "inside waters", bayous and lakes when they attain the length of 7 millimeters (7/25 of an inch). Later a seaward migration evidently follows and these young, derived from eggs spawned in the spring of the year, form the bulk of the commercial catch of the following autumn. By late autumn they reach a length of about 120 millimeters (slightly under five inches) and remain approximately this size until the following spring when growth is resumed and the sexes differentiate in size. Spawning in the following spring, they continue into the summer and presumably die at the end of a year. This duration of life established by these investigations differs sharply from the ideas prevalent both among shrimp fishermen and earlier investi-



(Weymouth, Lindner and Anderson, 1933).

Frequency distribution of the population of the Common Shrimp, PENAEUS SETIFERUS (Linnaeus) for Georgia from February 1, 1931, to August 15, 1932. The corresponding frequency distributions for Louisiana and Texas follow with but few variations those for Georgia. The Georgia series is chosen for illustration because it represents a longer and less interrupted series.

The figures under each date give the number of males (above) and the numbers of females (below) which compose the half-monthly group. The measurements here graphed represent a total of 58,521 shrimp.

gators. Indeed many fishermen believe that shrimp attain an age of from 15 to 18 years.

The actually brief, one-year span of life of the shrimp has the important economic significance that a commercial fishery based upon animals which live but a single year is subject, if depletion sets in, to much more rapid and violent change. The interference by weather or other conditions with the success of even a single spawning season is capable of seriously impairing or even jeopardizing the entire stock, since there are not several year classes present at any one time, as in the case of other commercial fisheries such as, for example, the Haddock and the Herring. Spawning is shown by these investigations to occur when the males have attained a length of from 130 to 170 millimeters (5 1/5 to 6 4/5 inches) and the females 130 to 190 millimeters (roughly 5 1/5 to 7 inches). The adults then completely disappear and, as shown by the population size studies, make their exit from the commercial catch during the month of August. These investigations reveal that in addition to the changes in the sex glands (ovaries in the females and testes in the males) the two sexes attain at the breeding season a sharp differentiation in size, the females being the larger. Also, at the breeding season the numerical proportion of the sexes which has been approximately equal all during the growth period may undergo considerable fluctuation. Further, it is clearly shown that sexual maturity of shrimp, both males and females, is more abundant in outside than in inside waters.

ESSENTIAL STATISTICS BEING SECURED

The primary objective of every scientific investigation of commercial fisheries is to provide guidance in maintaining the fishery at its maximum production consistent with future welfare. It is clear that it is essential to learn whether the animals upon which the fishery depends are maintaining a constant level, or whether they are increasing or are decreasing in numbers. These facts determine the whole procedure of exploitation or of protective legislative restriction.

At the initiation of these researches it was apparent that available statistics of shrimp production were valueless as data from which to determine the state of the fishery. It is the common experience of the fishery investigator that, however adequate ordinary statistics may be for administrative purposes, they are almost useless as biological data. To provide more precise statistics which would furnish adequate material for scientific analysis, the State of Louisiana has inaugurated a system of returns which will be briefly described.

Statistical material is to be found in the record books of private companies engaged in the fishery. Shrimp packers in Louisiana have been generous in making available for study all of their records. However, examination has shown that they are not the material desired, since the lack of uniformity makes impossible comparison of the records of one company with those of another, and even a comparison of the records of the same company at different periods of time, and, also, since long-period records of private companies are most rare, the longest available fall far under the requirements for a comprehensive study of long-period fluctuations, cycles in abundance or decline.

The Department of Conservation of the State of Louisiana has now in operation a system of shrimp returns which is designed to give statistics adequate for analysis in terms of productive effort.

The operatives in the shrimp industry of Louisiana are asked by the Department of Conservation to fill out, in triplicate, shrimp receipts bearing the data enumerated below.

The return forms, serially numbered, are printed in books of 150 thus making it possible to account for every book. Not alone, however, will this system of returns provide material of high scientific value, but it will, it is hoped, procure a more accurate reporting of taxable commercial production and contribute to the increase of state revenues from this source.

It must be pointed out that although the majority of shrimp packers have cooperated in this statistical program, certain operators have not only failed to aid but have definitely refused to do so. The existing legislation does not provide for sufficiently complete data for the purposes of this statistical program by the Department and it is highly desirable that a measure be passed to enable the Department of Conservation to secure the complete collection of these returns. Such a law must include provision of penalties sufficient to enforce the systematic reporting of returns.

The forms, at present in use, serially numbered and printed in books of 150, are in triplicate. The data included on each form are as follows:

Date.
Name of Dealer.
Boat Name.
Boat Number.
Where Caught (approximate location).
How Caught (seine or trawl).
Length of Seine or Trawl.
Catch: pounds baskets barrels price amount.

The new measures should be so framed that all of the foregoing details will be required in these shrimp returns.

Total Shrimp Production

The following figures covering the shrimp fishery for the year 1931 (Fishery Industries for the United States, 1932) give the total production of shrimp in the United States and Alaska, the production by states and the production in Louisiana by Parishes. It must be noted that Mississippi, reporting a 1931 catch of 17,715,590 pounds with a value of $393,774, secured a large proportion of this quantity from Louisiana waters.

These figures cover the catch of all the different shrimp species commercially utilized.

Total United States Figures for Manufactured Shrimp Products, 1931

	Volume	Value
Fresh package	1,874,000*	$ 232,960
Frozen package	213,354*	32,024
Sun dried	1,422,387*	318,306
Cooked and peeled	1,671,455*	322,688
Canned	821,375†	3,982,247
Meal or bran	1,289‡	25,090

*Pounds.

†Standard cases of 48 No. 1 cans.

‡Tons.

1931 Shrimp Production by States

	Pounds Volume	Value
North Carolina	338,273	$ 13,975
South Carolina	2,635,336	91,167
Georgia	5,471,063	180,583
Florida	18,852,822	682,658
Alabama	2,475,200	65,676
Mississippi	17,715,590	393,774
Louisiana	35,148,226	844,061
Texas	13,814,373	458,152
Total	96,450,833	$2,730,046
PACIFIC COAST		
Washington	68,261	$ 4,096
California	1,688,877	26,343
Total	1,757,138	$ 30,439
NEW ENGLAND STATES		
Massachusetts	1,000	$ 1,925
Total	1,000	$ 1,925
MIDDLE ATLANTIC STATES		
New York	159,350	$ 41,791
New Jersey	180,560	6,655
Total	339,810	$ 48,446
MISSISSIPPI RIVER SHRIMP		
Louisiana	38,503	$ 2,423
Mississippi	10,000	1,500
Total	48,503	$ 3,925

Louisiana Shrimp Production for 1931

Number of trawls—1,678.
Catch taken by cast nets—2,350 pounds. Value $118.
Otter trawls—34,547,316 pounds. Value $829,543.

SHRIMP CATCH BY PARISHES

	Volume Pounds	Value
Cameron	127,000	$ 2,944
Iberia	178,700	4,364
Jefferson	9,659,642	231,824
Lafourche	7,592,068	182,215
Orleans	1,445,522	34,750
Plaquemines	5,796,106	139,105
St. Bernard	613,224	14,718
St. Charles	598,000	14,352
St. Mary	2,207,256	53,425
Terrebonne	6,698,128	160,767
Vermilion	232,580	5,597

Trend of Development of Shrimp Fishery

The figures for total shrimp production in the United States covering the period from 1880 to the present time, analyzed by Weymouth in 1931, reveal the interesting fact that over this period of fifty years the shrimp fishery has continued to grow at such a rate that the total catch has doubled in about every eight and one-half years. This steady and regular increase is deviated from only in the period from 1887 to 1890 when for four years the catch was much greater than either immediately before or immediately after this time. This expansion of the shrimp industry is shown in an accompanying graph.

Further examination of shrimp production figures which cover the canned and dried shrimp yield and date back only to 1921, indicate that the production of canned shrimp, while increasing steadily, has not equalled the total catch in rate of growth. Here, as in other economically exploited marine resources, the volume of production is found to be directly related to price, fluctuating downward when the price is low and upward when the price is high. Available figures for "green" or fresh shrimp are not of such character that they can be used to indicate the progress of this division of the fishery although the indications are that such use of shrimp has increased proportionately more rapidly than have the other types of marketing.

The relationship between this growth of the shrimp fishery, roughly doubling as it does in a period of every eight and one-half years, and the fishing effort responsible for its production is unfortunately an equation that cannot be set down, since, as elsewhere stated, in this report, earlier available shrimp statistics do not permit the working out of any "unit of effort" measure of the shrimp yield. Differently stated, it is simply not possible to set down a curve representing the increase in boats, the increase in men, the changes of gear and the increase in fishing hours which were required to produce year after year the total shrimp yield and compare this curve with the curve representing the increase, relatively regular and steady, of the total shrimp catch.

The Department of Conservation, with the cooperation of the Federal members of the Shrimp Investigations, has now worked and has in operation a system of shrimp returns designed to provide hereafter the data necessary for such comparison. The figures of total shrimp catch for the South Atlantic and the Gulf States are represented in the accompanying graph and range from a total of some two million pounds in 1880 to the high point in the year 1928 of a total, for the South Atlantic and Gulf States, of 115,480,000 pounds with a value of $4,550,000. Thereafter, because of economic conditions, the total yield abruptly declined to eighty-eight million pounds in 1930.

It is because of this rapid expansion of the fishery that a fundamental knowledge of the life history and the general biological relations of the animals providing its raw materials are so essential, since it is obvious that no organism, under ordinary conditions, is capable of bearing up indefinitely under the strain of a commercial fishery expanding at this pace.

The established general characteristics of the life history of the sea shrimp have a most important bearing upon the conservation of this marine resource. These are the relatively narrow distribution of the sea shrimp in both space and time, or in other words, the single year span of life of the animal and the relatively close inshore restriction in occurrence of the species. The short life period, in which it seems clear the animal attains its size in a single year, then spawns and dies, makes the species vulnerable to severe and possibly disastrous effects should even a single highly unfavorable spawning season occur. The relatively close restriction in space likewise increases the hazards which beset the species, since, should some major change in conditions force the organisms into areas on either side of their comparatively narrow band of distribution. it seems clear that the animals would be then subjected to possible serious danger.

"IODINE" SHRIMP

"Iodine" or "Formaldehyde Shrimp" are familiar to many people as that condition in which shrimp are found at times to have a pronounced "iodine odor". Observation and inquiry have revealed that not only do shrimp display this phenomenon but likewise Crabs, *Callinectes*, Croakers, *Micropogon undulatus* (Linnaeus) and Speckled Trout, *Eriscion nebulosus* (Cuvier and Valenciennes). Wild ducks of various species have also been found at times to exhibit this condition. Shrimp which have the iodoform odor may not give much evidence of it until they are boiled, when the taste and odor may become so strong that the particular lot must be discarded. It is the popular and completely erroneous belief that "Iodine Shrimp" are due to the application of some preservative to the freshly caught shrimp by people handling them. Another popular view is that the shrimp acquire this taste and odor through eating sea weed. It seems to be clearly indicated, however, that this condition is due to the fact that the shrimp have been feeding upon a curious marine form, the Acorn Worm (Balanaglossus or related genera), which animal possesses the extraordinary power of secreting iodoform in the tissues of its body. So pronounced is the presence of this substance that an observer who handles Acorn Worms will, after repeated washings of his hands, still be able to detect, strongly and unmistakably, the typical iodoform odor. The mechanism of and the purpose for this secretion of iodoform by Acorn Worms remain unknown to science. It is obvious that should shrimp feed upon Acorn Worms and thus include in their alimentary tract sufficient quantities of iodoform tissues, the odor and taste would be greatly increased when such shrimp are boiled.

It should be emphasized that this odor and taste are not caused by any addition of preservative by the people handling the shrimp, and, furthermore, there is no evidence whatever available that this substance, objectionable because of its odor and taste, is in the slightest degree harmful. It is, in fact, possible that this substance in such concentrations is beneficial rather than otherwise when eaten by human beings.

A more extensive account of this subject will be found in the Conservation Review for December, 1931, and in the Bulletin of the Department of Conservation, Number 23, "Fishes and Fishing in Louisiana", pages 76 to 81.

EFFECT OF TRAWLING UPON FISHES

During the conduct of the present shrimp investigations an immense mass of data has been gathered covering the numbers and kinds of fishes and other animals which are taken during the commercially practiced trawling operations for shrimp. This evidence consists of complete and accurate records of every experimental trawl haul made by the "Black Mallard" as well as the corresponding data for every trawl haul made by the Georgia research boat in the waters wherein she operates. Those figures covering the Louisiana waters are being presently worked up by Mr. Gordon Gunter and will shortly be published. They provide for the first time systematic and "year-round" detailed evidence upon which to base an estimate of the destruction of game and commercial fishes effected by shrimp trawling in Louisiana.

Corresponding figures from Georgia waters presented by Lindner in the Conservation Review, April, 1933, cover 386 hauls made with ordinary commercial gear in the inside tidal waters and reveal the capture of a total of 530,175 fishes, an average of 1373½ fish per haul. The following table gives Lindner's analysis of these figures:

Species	Aggregate No. of Individuals of Species Taken in a Total of 386 Hauls	Average No. of Fish Per Haul (Fractions Disregarded)
Bullhead Minnow or Star Drum, *Stellifer lanceolatus* (Holbrook)	238,354	617
Spot, *Leiostomus xanthurus* Lacepede	49,174	127
Croaker, *Micropogon undulotus* (Linnaeus)	45,809	119
Summer Trout or Weakfish, *Cynoscion regalis* (Bloch & Schneider)	29,952	67
Whiting or Kingfish, *Menticirrhus americanus* (Linnaeus)	11,584	30
Bluefish, *Pomatomus soltatrix* (Linnaens)	394	1
Various other Species	158,909	412

As indicated, almost half the total number of fish caught (45%) consisted of Bullhead Minnows, a small member of the Croaker Family that is of no direct sport or commercial value, although indirectly it is of probable importance as a source of food for various sport and commercial species. Five fishes regarded as sport species, the Croaker, the Spot, the Summer Trout, the Whiting and the Bluefish, make up 45½% of the total fish caught. The size of the fish taken in shrimp trawling is in general too small for them to be of commercial use and they thus represent the destruction of a potentially great mass of fish.

SUMMARY

The results of the shrimp investigations reveal a rapid growth rate and a short life span for this organism. The bulk of the fall commercial catch is clearly made up of shrimp spawned the previous spring.

Spawning extends widely throughout the year occurring from March or April through to August and September.

Spawning is indicated, by several accordant lines of evidence, to occur in the Gulf of Mexico and along the South Atlantic States in waters of high salinity.

Studies have revealed the existence of a shoreward migration on the part of the young stages, such stages being absent from the seaward beaches and being found, when measuring as little as 7 millimeters (7/25 of an inch) in length, in the waters of inside lakes, rivers and bayous.

The growth rate of the shrimp is found to be high, the total length reaching 120 millimeters by the advent of winter. Growth again speeds up in the following spring time and it has been found that males are ready to spawn when they have reached a length of 130 to 170 millimeters (5 1/5 to 6 4/5 inches), the females, 135 to 190 millimeters (5 2/5 to 7 3/5 inches).

The adult shrimp thereafter disappear from the fishery and it is presumed that they die.

The short length of life of the shrimp and its relative restriction in territory, since this species is not found to occur far offshore, make more dangerous the probable course of events should depletion set in. This aspect thus makes exceptionally necessary the close and continuous observation of shrimp production so that the advent of depletion may be quickly detected and the necessary legislative changes to control such depletion may be immediately employed.

RECOMMENDATIONS

A new statistical reporting system highly valuable in the detection of depletion has been worked out by the members of the shrimp investigations and is now in operation under the control of the Department of Conservation of Louisiana. It is emphasized that present legislation is not adequate in the details of the returns required, and it is recommended that a measure be passed to establish such necessary authority. (See above).

In view of the information which has been thus far secured in the shrimp investigations, the Bureau of Research recommends no change in the present close season.

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Crop Plants of Louisiana; How, When and Where They Originated

Editor's Note: Inasmuch as we have been unable to obtain pictures of the original crop plants of Louisiana, we have been compelled to avail ourselves of illustrations showing the evolution and progress of these plants.*

By
ROBERT GLENK, Ph. M.
Curator, Louisiana State Museum

LOUISIANA is predominantly an agricultural state, deriving its income largely from the products of the soil.

Yet, strange as it may seem, agriculture was very backward in developing in the young colony and the early settlers from France found it difficult to procure food and were obliged to import supplies from the mother country and from the West Indies to avoid starvation.

The local tribes of Indians cultivated to a limited extent maize, beans and pumpkins; but not enough were produced to feed a growing colony of settlers in the new land of promise.

Besides, the French colonists preferred wheat flour to corn and the crops of wheat which they planted yielded a very precarious harvest. Fish and game were plentiful and in their season, nuts, wild growing millets, berries, and roots; but the supplies were uncertain and inadequate. Persimmons grew in great abundance and bread and cake were made from the dry fruits which were known by the French as "plaquemines."

The cereals, legumes and fruits of the old world were totally unfamiliar to the ancestors of the present day Indians. They learned not only to gather wild plants for their food, but discovered and domesticated such native species as maize, beans, potatoes, sweet potatoes, Jerusalem artichokes, squashes, pumpkins, garden peppers, tomatoes, peanuts, sunflowers, cotton and tobacco and many others which have proved to be of great benefit to humanity and are now spread all over the world.

This primitive husbandry was the true beginning of agriculture in America. While much inferior to the European races in the art of warfare, the aboriginal people of America had attained higher development in the domestic arts and in agriculture, and early accounts of Mexico and Peru reflect the astonishment of the Spanish explorers at the extent and development of native cultures.

The consideration of the subject from an historic standpoint is both interesting and instructive, as it fixes the mind on the progress of the past and enables one to a certain extent to foresee the possibilities of the future in improved horticulture and agriculture.

As most cultivated plants have been under domestication for a long time, often very little is known of their antecedents or of the manner of their introduction into our system of present

(Top) Cutting Sugar Cane in One of Louisiana's Large Cane Fields.
(Bottom) Transporting Sugar Cane from Field to Mill.

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*The engravings were kindly loaned the Department of Conservation by Hon. Harry D. Wilson, Commissioner of the Louisiana Department of Agriculture.

day farming. The widespread cultivation of corn, tobacco and sweet potatoes shows considerable antiquity in America, at least more than 20 centuries of time, but as compared with the civilizations of Asia and Egypt, our cultures are comparatively recent unless further discoveries of archaeologists extend this period of time backward.

The problem appears at first glance to be easy enough to solve by consulting floras, examining herbaria for allied species or by finding the geographical location of spontaneously growing specimens. The botanist is, however, at a disadvantage in being dependent mainly upon special knowledge to be gained only from long experience and from recorded facts secured by the archaeologist and geologist in his research in differentiating the original ancestor of many cultivated plants.

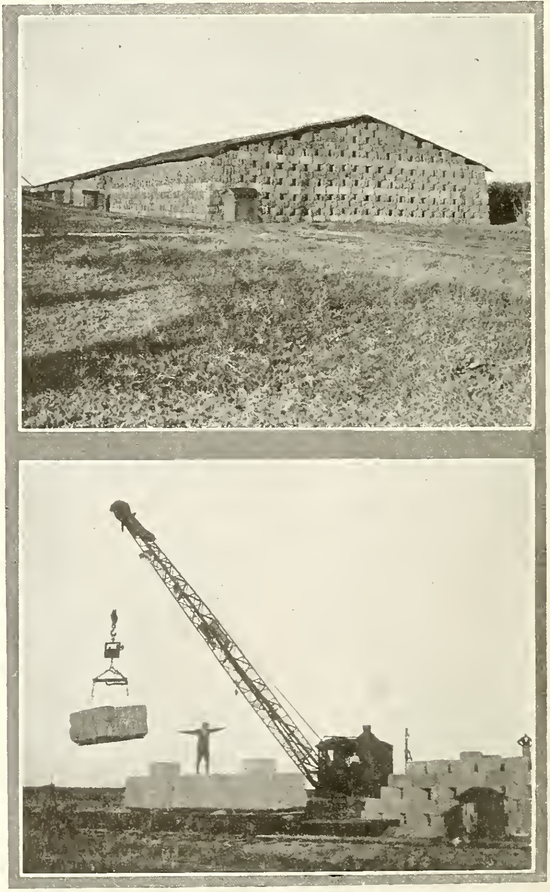
The finding of evidence, in the form of recognizable fragments in sites formerly occupied by man and of a more or less certain date, often gives direct proof of the existence of a species now under cultivation. In this fashion, Indian mounds in North America and the monuments of Aztecs, Mayas and Toltecs of Mexico and Incas of Peru have furnished testimony about plants employed as foods or in the arts in those countries.

Graves containing terra cotta jars have been found which contained well preserved foodstuffs such as maize, beans, peanuts, peppers, white and yellow potatoes, sweet potatoes, and cotton fibers, thus giving rise to important clues as to the date or the period of time of the particular civilization to which the plants belonged.

Furthermore, plant fossils often tell something about the succession of vegetable forms. Usually, however, they deal with epochs so far anterior to agriculture that recognition of reliable evidence becomes difficult to establish.

Though only a partial utilization of American cultivated plants has as yet taken place, the entire world has profited and vastly increased its productions thereby.

The significance of the occurrence of a new economic flora in America, as affording new materials for human advancement and for contributing to the enrichment of Europe's civilization, is not sufficiently emphasized by scientists and historians.



(Top) Enormous Stock of Bagasse, the Refuse of Ground Sugar Cane, in Storage for Future Use in Manufacturing of Celotex. This Splendid Building Material Is Manufactured in New Orleans. (Bottom) Loading Some of the Same Material.

The discovery of America and the voyages of early explorers, and the widening facility of the means of communication and transportation combined with the general trend of crop improvement, brought about that common dispersion of useful plants of which we are witnesses at the present day.

The astonishing number and variety of plants now cultivated in Louisiana have come from all quarters of the globe.

How, when and where they all originated may be impossible to determine, but the history of the more important commercial crops of the state is fairly well authenticated and is well worth knowing.

Three of our principal crops, namely cotton, corn and tobacco are considered to be tropical cultures by European agriculturists and places the United States quite definitely in the tropical category, as the short summers of Continental Europe make it impossible for these crops to mature except in a few restricted localities. The same applies to sugar cane and rice.

The total value of all agricultural products of Louisiana is estimated at 200 million dollars annually.

Ranking in importance from an economic standpoint are cotton, sugar cane, corn, rice and sweet potatoes.

Next in importance are forage crops, strawberries, Irish potatoes, tobacco, peanuts, oranges, figs, pecans, peaches, tomatoes, cabbages, pumpkins, watermelons, cucumbers and onions.

SCENES IN LOUISIANA'S RICE FIELDS.
(Top) During the Growing Season. (Bottom) Thrashing the Ripe Grain.

These will be discussed in the order of their economic importance in the commerce of the state.

COTTON

The cotton plant has been cultivated both in India and in warmer sections of the New World from time immemorial.

Herodotus states that trees growing wild in India produce a wool like a sheep's wool and of which the natives make their clothes.

Theophrastus also writes about the trees from which cloth is made that resemble a "dog-rose." Other ancient writers, contemporary with Alexander the Great, mention the cotton plant as the "wool bearing tree of India."

Its introduction into China dates back many centuries, but it was not until the 13th century of our era that it was cultivated for general use. In Egypt, both the cotton and the flax plants were grown for their fiber according to Pliny and both cotton and linen cloths were acceptable to the Priests for their garments and not in conflict with religious rules against the use of animal products.

The Arabic name of the plant is "Kutn" and has given rise to the various names in modern languages as "cotton", "coton", "cotone" and "algodon", while the Indian and Sanskrit names are respectively, "Karpase" and "Karpasi". There are no records to show that cotton was cultivated in Italy before the Christian Era, but a knowledge of the use of cotton in the manufacture of cloth, was common among the early Romans.

Its introduction into southern Spain along with that of rice and sugar cane was brought about by the Moors.

The early Spanish explorers found cotton abundantly growing in the West Indies, Mexico, Brazil and Peru, where it was used for making clothing, fish nets and hammocks. Cortez sent to Charles V of Spain cotton fabrics made into mantles, coats, counterpanes and tapestries as presents from the new country.

That the cultivation of cotton in America dates back to remote times is evidenced by the fact that cotton seed and fiber are found in the burial urns of the Incas of Peru.

The first effort to produce cotton in North America was probably made at Jamestown, Va., in 1607.

In 1697, the cultivation of cotton as a commercial crop in the French Colony of Louisiana was suggested to Count de Pontchartrain, and the first planting is said to have been done in 1699 by the Houma Indians from seed distributed by Iberville.

In 1733, Bienville reported upon the success of the cultivation of cotton near New Orleans by the colonists.

In 1752, interesting details of the growing of cotton in Louisiana were given by Michel, telling of the difficulty of separating the lint from the seed.

Le Page du Pratz mentioned the fact that Siam cotton was being planted in the colony in 1758, which Capt. Bossu characterized as being not so long a staple but white and fine.

Dubreuil, a Louisiana planter of cotton and cane, invented a roller gin for delinting the seed but nothing is known of its success in practice. W. C. C. Claiborne, writing about the farmers of Mississippi in 1794, said that the seed cotton was obtained from Georgia and Jamaica, and that the lint was white and fine but difficult to gin.

Much of the seed cotton planted in the early nineteenth century in Louisiana seems to have come from Mexico.

In 1774, a bale of North American grown cotton was confiscated in Liverpool on the plea that cotton did not grow in the American colonies.

BUSY IN THE STRAWBERRY BELT.

It is now stated on authoritative basis that the American upland cottons are derived from *Gossypium hirsutum* originating in America and not from *Gossypium herbaceum* of India as has been heretofore believed to be a fact and stated in most textbooks.

Many Asiatic varieties were experimentally planted here but proved to be much less productive than upland types from tropical America.

SUGAR CANE

The home of the sugar cane, as of so many other domesticated plants, is India—where it seems to have thrived from time immemorial according to Sanskrit writings.

At the time of his conquest of Asia in 327 B. C., Alexander the Great found the sugar cane already growing in India and the first historical account of the culture of sugar cane reached Europe along with the cane which they brought home.

It was not until the third century of the Christian Era, however, that sugar became an article of commerce. Sugar cane was introduced into the East Indies, Philippines, Samoa, Tahiti and others of the islands of the South Pacific by the daring native navigators. Capt. Cook, on his voyage to the Hawaiian Islands, found sugar cane growing there at the time of his arrival. The Persians were the first to transport the sugar cane westward from India as their country adjoined India.

The Arabs next introduced the cane to the nations of Europe, as the Mohammedans in their conquests of Persia and India came in contact with the culture of sugar cane and transplanted it to the conquered nations. Their familiarity with the arts and sciences was of great service to them in giving an impetus to this enterprise.

We find the substance sugar, as we know it, first spoken of by the great Arabian scientist Avicenna about 1000 A. D. From this time onward the manufacture of sugar greatly increased and, from being an expensive luxury, it became one of the cheapest food commodities of recent times.

With the extension of their conquests westward, the Arabs carried the sugar cane from the Tigris and Euphrates into Asia Minor, Egypt and North Africa, the Mediterranean islands and finally into Southern Spain where its culture still survives.

In 1420 the Portuguese transplanted the sugar cane to the Atlantic islands, Madeira, Canary and Azores, whence it was transported by Columbus on his second voyage in 1493 to San Domingo. There the cane thrived so well in its new surroundings that the planting of cane rapidly spread to Cuba, Mexico, Brazil and other provinces in the New World.

In Louisiana, the first mention of its cultivation was made in 1725-26. Bienville in 1733 found that the colonists had taken up its cultivation for the production of syrup.

The Jesuits of San Domingo sent a shipment of sugar cane and skilled negro planters to New Orleans for the purpose of establishing an industry in the new colony in 1751, but the cane did not mature well and all attempts to make sugar resulted in failure. The variety introduced is known as the "Malabar" cane.

In 1758 a planter named Dubreuil made large scale experiments and erected the first sugar factory in Louisiana. He turned out a kind of Muscovado sugar and also made syrup and rum, but it was not until 1764-65 that the first shipment of this type of sugar was made to France. There is also a record of sugar export and production of molasses and rum in 1769.

From then until 1795, very little data is available as to the production of cane or the manufacture of sugar. In that year it is recorded that De Boré sold his crop of sugar for the sum of $12,000.00 and started the sugar industry of Louisiana on a profitable basis.

In 1802 the cane products marketed in New Orleans amounted to five million pounds of sugar, 250,000 gallons of molasses and 200,000 gallons of rum.

It took 300 years from the time of the introduction of sugar cane into the West Indies before the sugar industry was established on a paying basis in the New World.

How profitable the industry became at the time of the cession of Louisiana, we learn from a letter written by Governor Claiborne to President Jefferson in which he states: "The facility with which sugar planters amass wealth is almost incredible. It is not uncommon with 220 working hands to make from 10 to 14 thousand dollars and there are several planters whose field negroes do not exceed 40, who make more than $20,000 a year."

This was with the old varieties of canes.

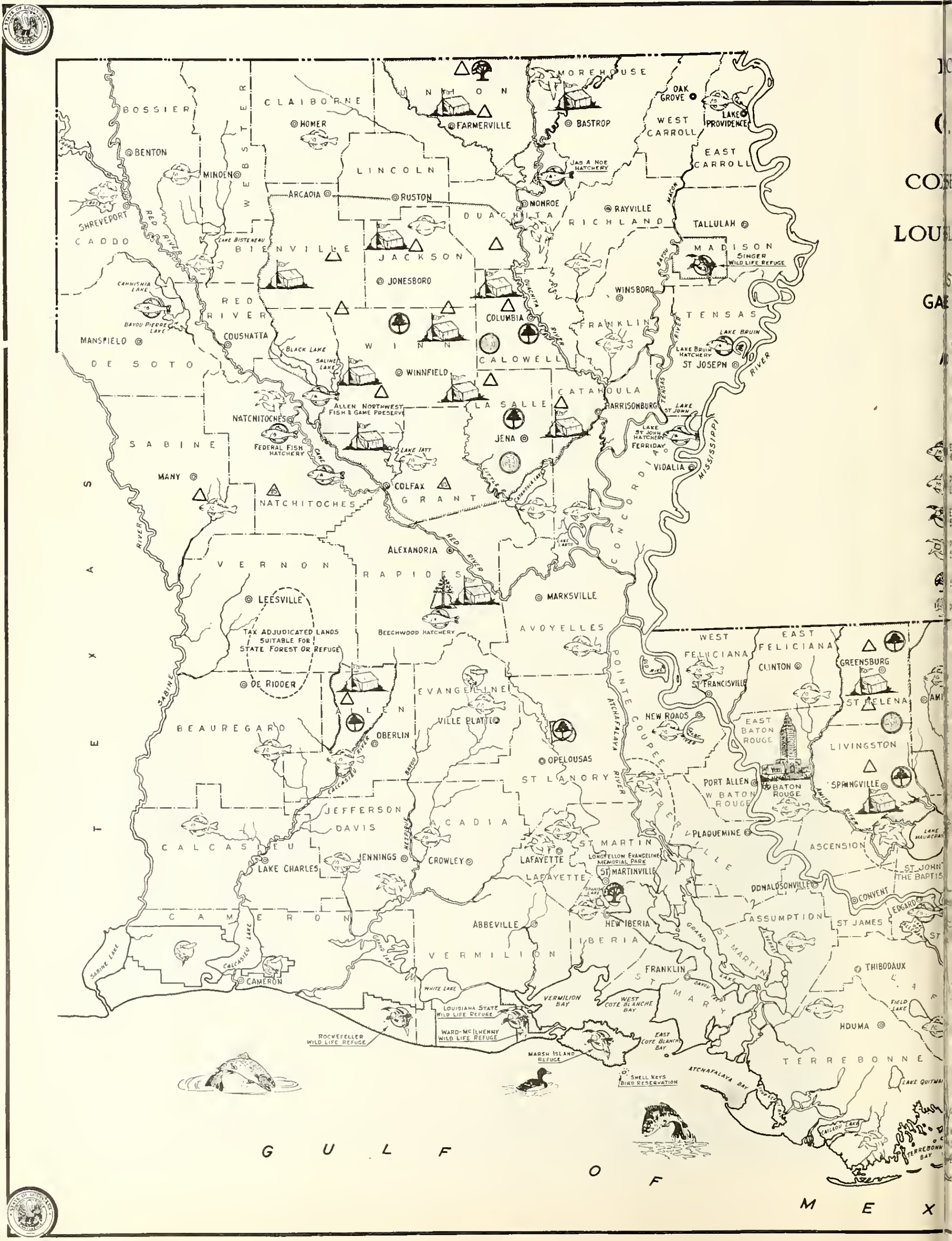
In 1919 mosaic disease of sugar cane developed and all the old types and varieties had to be discarded for new and hardier and disease resistant types of canes developed as seedlings in Java and elsewhere.

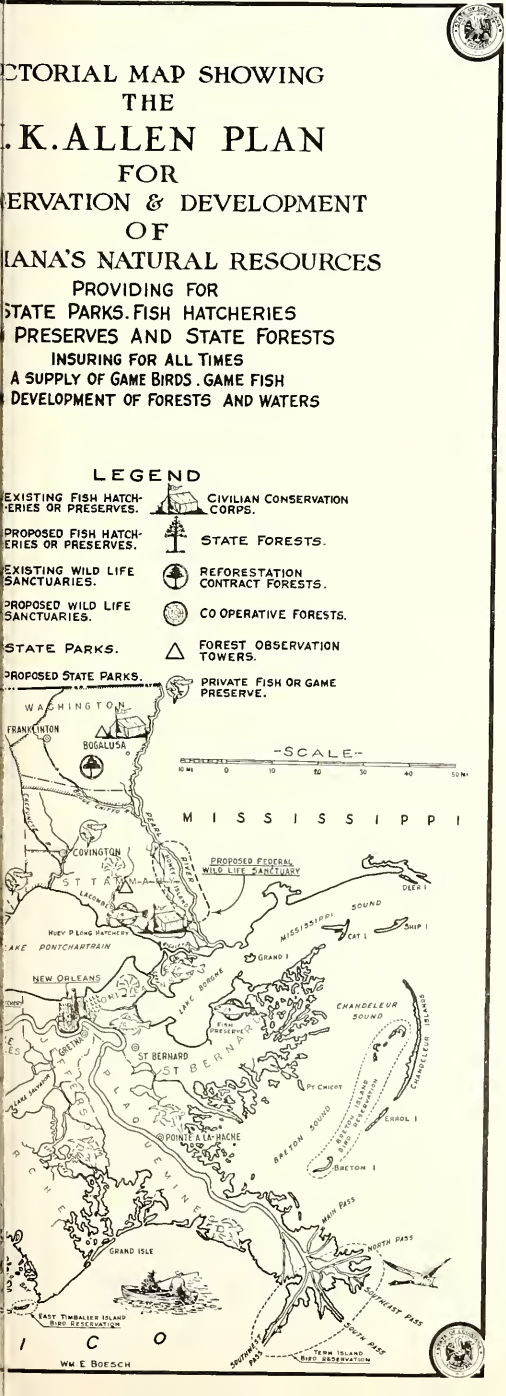
MAIZE OR CORN

Botanists concede almost unanimously that the corn plant is indigenous to America.

It seems to have been cultivated from Canada to Argentina long before the first white settlers came from Europe, and was quickly adopted by them as an article of food from the Indians.

AN EXTENSIVE ORANGE GROVE ALONG THE HIGHWAY IN SOUTH LOUISIANA.


BOSSIER
BENTON
CLAIBORNE
HOMER
UNION
FARMERVILLE
MOREHOUSE
BASTROP
OAK GROVE
WEST CARROLL
LAKE PROVIDENCE
EAST CARROLL
WEBSTER
MINDEN
LINCOLN
RUSTON
ARCADIA
JAS. A. NOE HATCHERY
MONROE
OUACHITA
RAYVILLE
RICHLAND
TALLULAH
SHREVEPORT
CADDO
RED RIVER
LAKE BISTENEAU
BIENVILLE
JACKSON
MADISON
SINGER WILD LIFE REFUGE
CANNISNIA LAKE
JONESBORO
WINSBORO
BAYOU PIERRE LAKE
COLUMBIA
FRANKLIN
TENSAS
MANSFIELD
COUSHATTA
LAKE BRUIN
LAKE BRUIN HATCHERY
ST JOSEPH
DE SOTO
BLACK LAKE
SALINE LAKE
WINN
WINNFIELD
CALDWELL
LA SALLE
CATAHOULA
HARRISONBURG
LAKE ST JOHN
ST JOHN HATCHERY
FERRIDAY
ALLEN NORTHWEST FISH & GAME PRESERVE
NATCHITOCHES
SABINE
FEDERAL FISH HATCHERY
CANE
LAKE IATT
JENA
VIDALIA
MISSISSIPPI
CONCORDIA
MANY
COLFAX
GRANT
CATAHOULA LAKE
LITTLE
NATCHITOCHES
SABINE RIVER
TEXAS
VERNON
ALEXANDRIA
RAPIDES
RED RIVER
LAKE LARTO
LEESVILLE
TAX ADJUDICATED LANDS SUITABLE FOR STATE FOREST OR REFUGE
BEECHWOOD HATCHERY
MARKSVILLE
AVOYELLES
DE RIDDER
ALLEN
EVANGELINE
WEST FELICIANA
EAST FELICIANA
ST FRANCISVILLE
CLINTON
GREENSBURG
ST HELENA
AMITE
POINTE COUPEE
NEW ROADS
BEAUREGARD
OBERLIN
VILLE PLATTE
ATCHAFALAYA RIVER
EAST BATON ROUGE
LIVINGSTON
OPELOUSAS
ST LANDRY
PORT ALLEN
W BATON ROUGE
BATON ROUGE
SPRINGVILLE
CALCASIEU RIVER
BAYOU
JEFFERSON DAVIS
ACADIA
PLAQUEMINE
IBERVILLE
ASCENSION
LAKE MAUREPAS
CALCASIEU
LAKE CHARLES
JENNINGS
CROWLEY
LAFAYETTE
ST MARTIN
LONGFELLOW EVANGELINE MEMORIAL PARK
ST MARTINVILLE
DONALDSONVILLE
CONVENT
ST JOHN THE BAPTIST
CAMERON
ABBEVILLE
NEW IBERIA
SPANISH LAKE
ASSUMPTION
ST JAMES
ST CHARLES
GRAND LAKE
VERMILION
IBERIA
GRAND LAKE
SABINE LAKE
CALCASIEU LAKE
CAMERON
FRANKLIN
ST MARY
THIBODAUX
LAFOURCHE
WHITE LAKE
LOUISIANA STATE WILD LIFE REFUGE
VERMILION BAY
WEST COTE BLANCHE BAY
WARD-McILHENNY WILD LIFE REFUGE
ROCKEFELLER WILD LIFE REFUGE
MARSH ISLAND REFUGE
EAST COTE BLANCHE BAY
SHELL KEYS BIRD RESERVATION
ATCHAFALAYA BAY
FIELD LAKE
HOUMA
TERREBONNE
LAKE QUITMAN
CAILLOU LAKE
TERREBONNE BAY
GULF OF MEXICO



PRESIDENT FRANKLIN D. ROOSEVELT, some three months ago, made an appeal for proposals and plans of worth-while projects to engage the unemployed. The Department of Conservation of the State of Louisiana was quick to respond; the result is largely shown, in graphic and striking form, on the map printed on this page.

When this plan was presented to the governmental agency, which was the National Park Service, it met, immediately, with high favor. Engineers and associated technicians began a thorough study of it with the result that each of the projects included in this program was carefully considered as an entity, separate and apart from the entire plan. Thirty-seven of the seventy-five projects contained in this plan, were immediately approved by the National Park Service. One of the most salient features of the Louisiana plan was the permanence of the benefit it would bring to the people of the State. Louisiana, richest State in the Union from the standpoint of natural resources, is pre-eminently ready to contribute more than any other State to the National Recovery Movement of President Roosevelt.

Mr. Roosevelt, by nature and by ardour a conservationist, has always advocated the protection and proper use of Nature's resources. This plan, which Louisiana submitted in response to his appeal, not only met the needs of the Nation from a recovery standpoint, but also fulfilled a personal desire of long standing on the part of President Roosevelt to promote the proper conservation and utilization of the natural resources of the Nation.

The National Park Service had but completed a survey of approximately half of these projects, when, in accordance with a new policy of the Federal Government, all new projects that had been allocated to the National Park Service were transferred to the Civil Works Administration. The Civil Works Administration, at that time, had just come into existence as the successor of the Emergency Relief Administration. Harry J. Early, who had been in charge of the Emergency Relief Administration in Louisiana, was, consequently, transferred to the important post of Civil Works Administrator.

Mr. Early, upon viewing the Louisiana Recovery Conservation Plan printed on this page, became, at once, very enthusiastic. He cited, among the many reasons wherefor he endorsed the plan without reservation, the significant fact that it contained benefits to the people of tomorrow as well as the people of today, such benefits as fish hatcheries, wild life sanctuaries, state parks, state forests, reforestation projects, co-operative forests, forest fire prevention work, game and fish preserves.

Mr. Early immediately requested that the staff of the Conservation Department provide him with a detailed outline of each of these projects. This request was met whole-heartedly by each official of the Conservation Department for they felt that since they had advocated Mr. Roosevelt and Mr. Roosevelt's policies to the electors of the State and had requested them to name him to the highest office in the land where he could put into effect such policies, they believed themselves duty bound to exercise their every power to bring these policies into a real, a worthy and a permanent achievement.

Mr. Early, so well impressed with the value of the Louisiana Recovery Conservation Plan, took it to Washington with him and there he conferred with officials of the United States Government. He repeated, upon returning to New Orleans, his approval and his desire to bring these plans into realization immediately. He also announced, at the same time, his approval of a farm restoration program, which had been discussed by him with some of the officials of the Conservation Department prior to his trip to Washington.

The Louisiana Recovery Conservation Plan to date has received no final action from the Civil Works Administration on any one of the new submitted projects, some of which are not shown on the map, however, every one of which would be of permanent value to the State, to the Public Works Administration, to the Emergency Relief Administration, and to the Civil Works Administration.

PEACH BLOSSOM TIME.

Burial mounds of the natives prior to the present day Indians and tombs of the Incas of Peru contained grains and ears of corn.

The Mexican Aztec goddess of agriculture bore a name derived from that of maize and at Cuzco in Peru, the virgins offered corn bread as sacrifice to the sun god. Darwin relates that he found ears of corn buried in the soil above sea level in Peru.

The name maize was given to the cereal by Christopher Columbus, adapting it from the native Haitian term "Mahiz." The ancient people of the old world were unfamiliar with corn, and it was not until 1644 that the grain was introduced into China and Asia. It is significant that the word "corn" which is the customary name for the small cereal grains, such as wheat, rye and barley of Europe, has been transferred in popular usage to the maize plant in this country.

Several Indian names for corn foods have been adapted into our language such, for example, as the familiar "hominy" and "succotash."

The Choctaw name for corn is "tonche."

While the corn plant has not been found strictly in the wild state, primitive corn, in which each grain is in a shuck by itself is well known as a curiosity; and close relatives of corn, among which is "Teosinte," have been known to yield fertile hybrids with the cultivated maize grown in Mexico and also in experimental plantings by Burbank.

The genus "Zea," to which corn belongs, includes exceedingly divergent forms with ears from 1 inch to 16 inches in length, with stalks from 18 inches to 30 feet high; and with from one to 34 ears to the stalk.

Many varieties of corn from tropical American countries have been brought to the United States and tested in different regions.

Under new conditions, the behavior of the variety may be completely changed and may become definitely abnormal. Cuzco corn of Peru, normally 6 to 7 feet high, grows to a height of 16 feet and usually fails to mature seed in the north.

The Quichua Indians raised popcorn in red, white, blue and yellow colors.

Mummy corn was soft and floury.

The first sweet corn recorded was raised by the Indians of Susquehanna in 1779 and was called "Papoon" corn.

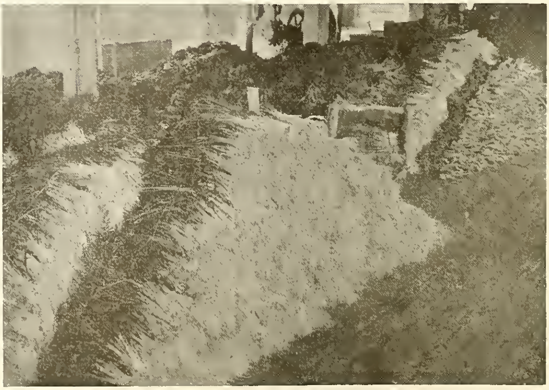
Maize formed the principal food of the De Soto Expedition, and all of the early explorers made use of the cereal in their rations while on the march and which they obtained by barter from the Indians.

Maize was first planted in the Louisiana colony in 1710 and has held a high rank as a commercial crop since 1816.

In line with the traditions of ancient America, maize or corn is now the preponderant cultivated crop of the United States.

RICE

Rice is the most important food plant of the world and one of the very oldest in the history of



LOUISIANA GREEN ONIONS.

agriculture. It played an important part in a ceremony instituted by a Chinese Emperor over 4500 years ago in which the Emperor must sow rice for the success of each year's crop.

It belongs to a family of grasses of numerous species in the wild state and covering wide areas of territory suitable for the growth of aquatic plants. It existed in Southern China and India long before its cultivation was begun, according to the researches of archaeologists.

The multitude of names and varieties also point to a very ancient culture.

Theophrastus mentions the fact of the cultivation of rice in India and other authors speak of its being grown in Cochin China and the Malay archipelago.

Through the expedition of Alexander the Great, rice was introduced into Greece.

From Babylonia it was spread to Syria and Egypt after the lapse of several centuries; thence to Carthage. Later it was distributed to Spain and Italy, about the middle of the fifteenth century.

The cultivation of rice began in 1694 in the United States from an experimental planting of gold seed rice, in the garden of the governor of South Carolina at Charleston. The seed was brought from Madagascar by a sea captain. During the colonial period, the crops grown from this planting increased sufficiently to supply the entire population, and as early as 1712 over three million pounds of cleaned rice were shipped to England.

A total of 76 million pounds of rice were exported in 1770, but after the close of the Revolutionary War, domestic consumption increased and exports became less.

In 1720 the cultivation of rice began along the Mississippi river points above New Orleans and in 1722 large plantings were made. The price paid at the warehouse in New Orleans was 12 livres per quintal.

A large harvest of rice was reported in 1726 and in 1728 rice became an article of export from Louisiana to the West Indies. Rice was offered at that time in place of money for slaves purchased on credit. In 1816 the rice crop was on a par with the value of the corn crop produced.

In 1839, rice grown in Louisiana constituted but four per cent of the total United States production, while South Carolina grew 70 per cent of the total.

The production of rice in the South Atlantic states was greatly affected by the Civil War, and the rice acreage along the Mississippi river in Louisiana began to increase rapidly, due in part to dearth of labor for the cane crops formerly grown.

It was not until 1887, however, that rice became an important crop in Louisiana when it was shown that rice could be grown profitably on the prairies in the southwestern part of the state by irrigation.

In 1889, Louisiana became the leading rice producing state of the Union, which rank it still holds.

The familiar "wild rice", which constituted one of the chief cereal foods of the Chippewa and other Indian tribes, is an entirely different plant from the oriental rice which is cultivated. The only resemblance to rice lies in the fact that it grows in shallow water.

SWEET POTATO

When Christopher Columbus returned from his voyage of discovery and appeared for the first time before Queen Isabella, he offered sweet potatoes as one of the productions which he brought from the New World.

In spite of its probability of an American origin, many uncertainties still exist as to its point of origin and source of distribution; and how it got to China from America, for instance, at the beginning of our era and to the Pacific islands at an early epoch.

It has been in cultivation so long that it is not known in the wild state anywhere, although certain species have a widely extended area both in the new and old world.

Of the known species of "Batatas," the greater number are found native to America and only a few in other countries with the probability that they were distributed by early navigators. The word itself is of American Indian origin.

Its cultivation extended from the Southern States to Argentina and from the Atlantic to the Pacific as well as the West Indies.

Sweet potatoes were cultivated in Spain as early as 1520 and were taken by the Spanish to the Philippines.

There is no mention of sweet potatoes in the writings of the ancient Greeks and Romans and only in the last hundred years has the plant become familiar to the Egyptians as a food crop.

It is widely diffused throughout India and most hot countries.

Sweet potatoes were grown as a cultivated crop by the Indians about Natchez where they were eaten by slaves who greatly relished them. They also constituted part of the soldiers' rations.

Prior to the colonization of Louisiana no sweet potatoes were grown, but later they formed an important food crop and their production now is about fifth in value of the total crops of the state.

Sweet potatoes are sometimes confused with the tropical "yam" which is an entirely different plant and not grown in Louisiana.

STRAWBERRY

The strawberry has been known in the wild state from time immemorial and is one of the most widely diffused plants in the old as well as the new world. A cool climate is more conducive to the growth of the wild plant than a hot climate, but the wild strawberry is found at higher altitudes even under the equator.

It does not seem to have been cultivated by the ancient Greeks or Romans and not until the 15th or 16th century of our era was the berry domesticated in the south of Europe. Even in England wild strawberries were gathered until the middle of the 15th century, when they were transplanted from the wild state into the gardens "where they prospered best" according to one of the writers of that time. Shakespeare's references to the strawberry which he says "grows underneath the nettle" undoubtedly applies to the wild berries. Likewise the quotation of Ben Johnson "a pot of strawberries gathered in the wood to mingle with your cream."

Gerard in 1597 writing of the strawberry says that "they grow upon the hills in woods and in somewhat shady places and that they do well under cultivation in gardens."

The three principal varieties of wild growing strawberries from which most of the cultivated berries originated are said to be *Fragaria vesca* of Europe, *Fragaria virginiana* of the Eastern United States and *Fragaria Chiloensis* of South America. Shirley Hibbard states that the strawberries of Europe are mostly descended from a cross between the American and the Chilian stocks, while those of the United States are derived from the Virginian stock exclusively as this type is best suited for our climate.

The numerous varieties of cultivated strawberries originated as seedlings from these crosses of wild berries, both in this country and abroad.

In certain parts of Japan, strawberries are grown on steep terraces on the side of a hill, the plants set in between rocks cemented together to keep them from rolling off.

An interesting advertisement offering strawberry plants to growers of Louisiana in 1834 recently came to light, giving the names of the following varieties all of which are now obsolete: "Bath Scarlet; Grove-end Scarlet; Chili; Knevet's Pine; Hudson Bay; Wellington and Southelbora Seedling."

IRISH POTATO

When and by whom the potato was introduced into Ireland is not positively known but it is on record that it was being grown as a field crop even before 1663 as a safeguard against famine.

The name is a misnomer as the tuber is not a "potato" but a modified underground stem and it is not of "Irish" origin but originated in South America.

There is a great deal more of romance than of fact about the early accounts of its introduction into the agriculture of Europe and the United States. It seems that the "Potatoes of Virginia" that John Gerard wrote about in 1597 were not the familiar potato at all but the tubers of a leguminous plant "Glycine apios", an important and staple article of food of the Indian tribes east of the Mississippi river, known as Indian or bog potatoes by the colonists and "openaug" by the Indian name. They were the chief reliance of the colonists of New England in times of food shortage as they grew wild in the open woods.

Perhaps the first account published of the occurrence and use of the true potato, *Solanum tuberosum,* was written by Pedro de Cieza de Leon in 1538 from Ecuador. Cieza states that one of the principal foods of the natives of this section were "papas" growing in the elevated plateau of western South America. These potatoes were cultivated and after harvesting were dried in the sun and kept for long periods.

Padre José de Acosta, a Jesuit missionary in Peru, also wrote of the "papas" which he observed both cultivated and in their original habitat. The "chunyos" or dried potato tubers were used for making bread which was prepared from the ground dried tubers. The exact date of its introduction into Europe is not known but most likely it was carried over by the Spanish explorers.

Fully a century elapsed before the potato attained a reputation in Europe as a food staple. In Ireland, where conditions of soil and climate were suited to its cultivation, the peasants took up the growing of potatoes about 1660 and it became their only food crop, upon which with the addition of buttermilk they were obliged to subsist. Potatoes also were fed to the family pig, dog and the chickens.

The Irish also learned how to make whiskey out of potatoes.

The introduction of the potato as a field crop into England was extremely slow and not until 1700 were they commonly cultivated there, and not until 1739 in Scotland.

Its cultivation in France was also slow as the physicians of the early eighteenth century declared that "potatoes were poisonous and brought on many diseases." Furthermore, it was declared that the potato would ruin the soil wherever it was planted.

Parmentier, a prisoner in Germany, during the Seven Years War, obtained permission from Louis XVI to plant potatoes on a sterile sandy field as an experiment. Under the pretext of preventing depredations, he had the field guarded by soldiers in daytime, but at night, lured by the attraction of the forbidden fruit, the neighbors robbed the field and spread the fame of the potato as an article of food.

Realizing the value of the potato as a new food crop, Louis XVI said to Parmentier that "France will thank you some day for having found bread for the poor."

In 1719, a colony of Scotch-Irish immigrants established a settlement in New Hampshire and brought with them potatoes and flax. In this way the potato was first brought into the United States, where it was wholly unknown until that time and hence was called the "Irish" potato.

Its name in French is pomme de terre, meaning earth apple and in German, Kartoffel, a modification of tartoffel or truffle. The name in Spanish is the original name of the potato "papas," as it is known in Chili—its original home.

The story of the potato having been introduced into Ireland by Sir Walter Raleigh, was invented in 1693, a hundred years after his return from his voyage. The connection of Sir Francis Drake with the introduction of the potato is also unfounded.

The Irish potato was introduced into the West Indies from tubers grown in Ireland or England in the early part of the eighteenth century and from there into Louisiana at a later date.

The scientific name of the potato, *solanum tuberosum,* was given in 1596 by Kaspar Bauhin who accurately described the plant. Linnaeus afterwards adopted this name in his nomenclature.

The potato, a contribution of early American agriculture for the benefit of civilization, is now grown all over the world in temperate climates.

TOBACCO

At the time of the voyage of Columbus, the use of tobacco in the form of snuff and for chewing and smoking was everywhere the custom among the native populations of the New World. That the use of tobacco is a very ancient one is also shown by the fact that pipes in great numbers and often of artistic workmanship are commonly found in the Indian mounds of the United States and tombs of the Aztecs in Mexico.

The smoking of a "pipe of peace" was a ceremonial originated by the Indians in ratification of a treaty to end the wars and hostilities between the tribes and colonists.

It is conceded by all authorities that the tobacco plant is a native of the western hemisphere but the original ancestor of *Nicotiana tobacum* is not known in the wild state. There are about fifty species of Nicotiana found growing wild, all but two of which are native to America. Several of these wild growing species have been cultivated and may have been the means of originating certain types of present day tobaccos. One of these species produces a very strong and disagreeable tobacco called by the natives of Chile "devil tobacco."

In further substantiation of its American origin is the fact that the names "tobak", "tabok", "tamboc" are merely modified terms derived from the American name tobacco and adapted by the Chinese, Japanese and Persians The Arabic word "docchan" simply means smoke.

The original name "tobaco" is the native Haitian term for "tube" for smoking and for taking snuff, and the generic name is given in honor of Jean Nicot, the French ambassador to Portugal who is credited with the great service in getting for tobacco its official recognition. It was really Francisco Fernandez, a physician, who was sent by Philip II of Spain to investigate the products of Mexico in 1558, who first introduced tobacco into Europe.

Nicot, on his return to France in 1560, however, carried it to Catherine de Medici, the queen, and from the reception it met with from her and from other titled personages, it got its reputation and popularity. Lofty example and sanction of high life gave currency to any custom in those days.

It became popularly known as "Herba Regina," "Powder of the Queen" and "Queen's Heat." The French gave Sir Francis Drake credit for carrying it to England and there is no doubt but what Sir Walter Raleigh and Sir Francis Drake succeeded in making it a fashionable luxury.

Its cultivation in the Territory of Louisiana dates back to 1719 when Montplaisir with 30 laborers came here for the purpose of cultivating tobacco as the French planned to make tobacco an important commercial staple in Louisiana.

In 1722 one thousand hogsheads of tobacco were produced near Natchez to take the place of indigo which was not a "small farmer's" crop.

In 1740 indigo culture was largely abandoned in Louisiana in favor of tobacco, but an overproduction in 1747 produced a glut on the market which, together with unfavorable conditions under Spanish rule and increasing competition by Kentucky grown tobacco, induced the displacement of this crop by cotton and sugar at the close of the Spanish domination.

The French government in 1752 offered $7.00 per 100 pounds for all tobacco grown in Louisiana and delivered at a public warehouse and the Spanish officials offered the same price in 1776.

Tobacco was grown all along the Mississippi River as far up as Natchez.

It was Pierre Chenet who introduced a new method of curing tobacco among his fellow Acadians who had been refugees from their native land and settled in St. James Parish in 1805, and this process without modification is practiced today in the parish.

The Creoles called this Pierre Chenet "Perique" on account of his diminutive size and it was destined that the name of the tobacco which he grew and processed should be handed down as "Perique tobacco" and which is now grown and manufactured by his descendants and others who founded the industry, which depends upon the curing of the tobacco in its juices and without foreign ingredients.

While its production now in Louisiana is on a relatively small scale, the amount of "perique" type tobacco manufactured elsewhere by this identical method runs into many million pounds each year.

PEANUTS

Much material has come to light during late years touching upon these strange leguminous fruits.

They are very common to early Eocene floras of the Rocky Mountains and in the form of a remote ancestor, *Leguminosites arachnoides,* it occurs fossil near Mansfield, La.

While the fossil species are well distributed, strange to say all the living species are found native to Brazil.

The cultivated peanuts in America are shown to have great antiquity, even occurring in burial jars in the ancient Peruvian tombs. There are also records to show that its cultivation in West Africa dates back about three hundred years, although the ancient Egyptians and Arabs seem to have been unfamiliar with the peanut.

Likewise, nothing in the literature of Greece or Rome would indicate that the species was grown in these countries at the height of their civilization.

At the end of the eighteenth century its was generally cultivated in India, Cochin China, Japan and the Philippines.

De Candolle considers it quite probable that the nuts were carried by slave ships from Brazil to Guinea in Africa and that the Portuguese navigators distributed the peanut among the islands south of Asia about the end of the fifteenth century.

José de Acosta, Jesuit missionary, mentions the peanut under the name Mandubi or monkey nut as being of American origin; Sloane states that the slave traders used the peanut to feed the slaves on their voyage to America.

From Brazil it spread to the West Indies and Mexico and finally to the United States.

It is now cultivated in all countries where the summer's heat matures the fruits called nuts which have the curious tendency to ripen under the ground, hence their name *"hypogea."*

In Louisiana, peanuts are grown mostly for forage and the small Spanish type is preferred.

ORANGE

The genus is first noted in the Wilcox Eocene in the form of *Citrophyllum Wilcoxiana* Berry from Henry county, Tennessee, which approaches very closely to some of the modern forms of *citrus,* seemingly the oldest of the living plants, and of which there are many varieties widely distributed.

The multitude of cultivated varieties of the orange has made it difficult to distinguish the true wild growing and original species, especially in China, where the orange is indigenous and where, originally, wild growing fruits were utilized.

They have been cultivated from very early times and in the Chinese language each species or variety has a distinct name referring to particular characteristics of the fruit. Both the sweet and bitter varieties of oranges also grow wild in southern India and in Cochin China.

From the ease of its introduction into other suitable habitats by seed dispersal through the agency of birds, animals and man, the orange is now found distributed into all semi-tropical and tropical countries.

The Arabs planted the sweet and bitter orange in Palestine, Egypt and North Africa and the south of Europe, and the Portuguese voyagers extended its cultivation into Spain, Portugal and into various islands in the early part of the 15th century.

The orange was imported from San Domingo in 1740 into Louisiana where it flourished and produced extensive crops.

During the winters of 1748-49, 1767-68 and 1772-73, early records show that the trees were killed to the ground by severe freezes.

The orange tree was planted in all sections of tropical America the first century after the discovery by Columbus. Now groves of trees are found everywhere, and in many places it has run wild and behaves like a native plant.

The Bahia or Navel orange was introduced into the United States from Brazil, but most of the kidglove and other types of oranges were imported from China and Japan.

They are known as the "Golden Apples of Hesperides."

In southern France and also in Uruguay, both the sweet and bitter orange trees are grown almost entirely for their flowers and leaves from which orange blossom oil and water are distilled.

The fragrant oil obtained from the blossoms received the name of "Neroli Oil" from the fact that the wife of the Prince of Neroli used the essence for scenting gloves.

PEACHES

The peach or "tao" is spoken of in the writings of Confucius in the fifth century before the Christian era.

It has been found growing wild in different parts of Asia and in the neighborhood of the Caucasus Mountains. The Japanese encyclopaedia gives the Chinese name "tao" to the peach which is said to be a tree growing in the western countries, probably referring to the interior of China rather than the eastern provinces, and was introduced into Cochin China at a later date.

It must have been cultivated at a very ancient period as it was recorded two thousand years before it was transported to Greece and Rome.

The expedition of Alexander the Great very likely brought the fruit to the notice of Theophrastus who mentions the fact that it came from Persia, hence its name "*Prunus persica*" and also "peach."

The tree was introduced from Europe by the early colonists of Virginia and Carolina, and its cultivation was readily spread by seed distribution.

Peaches were already in cultivation among various Indian tribes along the Mississippi river upon the arrival of the French settlers.

They were very plentiful according to Le Page du Pratz in the village of the Tensas Indians.

Nuttall claims to have found wild peaches growing in Arkansas in 1812. A very remote ancestor of the peach "*Prunus nabortensis*" is found in fossil state in strata of the Wilcox Eocene at Naborton, La.

FIGS

The genus of plants, "*Ficus*" to which the domestic fig *Ficus carica* belongs, has a very ancient lineage. Numerous species are found fossil as far remote as the Eocene Period. *Ficus goldiana Lesq.* is abundant in the western half of the Mississippi embayment area in the Wilcox formation of Arkansas, Texas and Louisiana. In more recent times, leaves and even fruit of the wild *ficus carica* are present in the quaternary strata near Paris, contemporaneous with the mastodon. Painstaking inquiry shows that the prehistoric area of the fig tree was adjacent to the Mediterranean Sea.

At the present time the fig tree grows wild over a vast region of Europe, Africa and Asia, where the winters are not too cold.

The ancient Egyptians and early Hebrews were familiar with the fig and records are found on the early monument inscriptions and pictographs of the fruit. The ancient Egyptian name was "Teb" and the Arabic name "Tin."

Herodotus mentions the fact that the fig occurs in Persia and from there it was transported to China and India.

Homer in the Iliad merely speaks of the fig tree of Troy, and of the "sweet fig" in the Odessey, but no mention is made of its cultivation by the Greeks, the supposition being that the trees grew wild in Greece or in some of the islands, the name being "erineos." However, both the wild growing and cultivated figs are mentioned by Theophrastus and Dioscorides in their writings.

According to tradition, Romulus and Remus were nursed at the foot of a "fig tree" or "ficus," the Latin name.

The old names for the fruit and for the fig tree in early literature would seem to indicate that the fig is of very ancient culture and an article of commerce of the Phoenecians, Arabs and Syrians.

It is now spread over all sections of the world and many varieties are in cultivation for the fresh as well as the dried products. Figs were cultivated by the early colonists of Louisiana and obtained mostly from the south of France and Spain.

They were already grown by the Indian tribes

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on the Mississippi river before the arrival of the colonists. The trees were obtained from the English settlement in Carolina.

The type of fig grown in Louisiana does not usually develop seeds that are fertile. They do not develop to maturity except when pollinated and pollination is effected only by a certain kind of insect which lives over winter in what is termed a "caprifig." Caprifigs produce pollen but the fruit is not eaten and has no value except for pollination. The climate is unsuited to winter caprifigs here.

PECAN

The pecan is truly a native of Louisiana. The ancestral stock *"Carya Antiqua" Lesq.* being found fossil in the Wilcox Eocene deposits at Campbell's quarry, Cross Bayou, Caddo Parish, La.

The finding of the fossil prototype of the pecan is mainly interesting from the fact that it gives a clue to the possible age of the species to which the modern type of the tree is distantly related.

Long before the white man came to this continent, the natives living along the lower Ohio and Mississippi rivers, as well as those of east and central Texas, knew and esteemed the pecan as an article of food.

The first written references to this nut were made by Cabeza and Oviedo in 1533. De Soto in 1539, in his northern progress through the country of Indian Chief Casqui, found trees of a new type bearing "soft shelled nuts in form like bullets which the Indians had stored up for winter food."

Pecans were also reported by him as occurring at a place named "Nilco" probably in North Louisiana.

Its earliest discovery by the French and reported by Penicaut, who in 1704 ascended the Mississippi river to the village of Natchez, mentions the name "pecanes" as being commonly used by the natives.

Another somewhat later reference, based on trees seen in the northern range of the tree, is made by the Jesuit missionary, Father Marest, writing in 1712 from Caskaskia, Illinois, who states that "Pacanes" have a better flavor than most French nuts that he had eaten.

Charlevoix, 1721, also describes the remarkable "Pacaniers" and the "Pacane" nuts of the region of central Illinois.

Le Page du Pratz in his description of the Louisiana country comments upon the "Pacan" nuts as being very good to eat.

Don Antonio de Ulloa observes that "Pecanos" "a kind of walnut," "have a delicate flavor, a thin smooth shell and a shape resembling a date."

In 1799, Daniel Clark of New Orleans sent Vice-President Thomas Jefferson at Philadelphia a box of "Paccans" which he planted in his orchard in Monticello in 1800. Jefferson in his notes on Virginia written in 1781 from reports given him by travellers, calls it "Paccan" or Illinois nut and gives a botanical description of the tree.

The nut was known by a variety of common names. The early Spanish writers called it "Nogales" or walnuts; French explorers, Father Marest and Penicaut used the native name "pacane"; "Illinois nut" was given to it by the colonists from the East and George Washington called it the "Mississippi nut" in his diary for 1775; the "Illinois nut" in 1786; and in 1794, he used the name "Poccon nut" when speaking of it.

The first shipment of pecans to Europe consisted of nuts sent to England in 1761 by John Bartram to his friend, Peter Collinson. Thomas Jefferson in 1787 ordered a box of Paccan nuts sent to Paris to the Jardin des Plantes for cultivation in France.

The fact that the pecan tree is native to Louisiana is one of the greatest factors in the success of the commercial pecan culture.

A number of the finest thin shelled varieties originated in this state, among them being the "Centennial" from St. Charles Parish; "Frotscher" from Olivier, La.; "Van Deman" from St. James Parish; "Mammoth" from Convent, La., and "Carmen" from Mound, La.

Near St. Martinville and New Iberia, the original trees of fine varieties of nuts are still growing. Other fine native varieties of pecans are found in Texas, Arkansas and Mississippi.

From these wild grown trees, superior types of nuts are perpetuated by grafting or budding, the first successful results of which are recorded in 1822 from Edgefield, South Carolina, by budding on a hickory tree.

PUMPKIN

The pumpkin has been in cultivation in both the old and the new world for so many centuries that its origin is not yet clearly determined.

A variety of *"Cucurbita"* is found growing in Texas and apparently indigenous; also several species grow wild in Mexico and southwest United States. So it would naturally appear that the original habitat of the pumpkin is somewhere in America.

The great variations in the shape and in the other characteristics of the fruit indicate a very long period of domestication. The Patagonian pumpkin has a very large cylindrical fruit; the Brazilian type is rather sweet; the vegetable marrow has a long slender fruit and the Barberine has a knobby fruit. Many other varieties exist as garden crops which, no doubt, are the result of selection and cultivation for their particular characteristics.

It is not improbable that the pumpkins which the old Romans cultivated and those which the Indians of North and South America cultivated may have been developed from two distinct original species in remote times.

The winter or crookneck squash or "Cushaw", as it is known in Louisiana, originated in Canada from the species of *"cucurbita Moschata."*

Pumpkins or squash, as they are indiscriminately called, were cultivated by the Indians when the early colonists arrived in Louisiana and are consequently a native crop.

TOMATO

The tomato is undoubtedly of American origin and very likely native to Peru where several wild species are found growing on the seashore. Wild forms are also found in Mexico, California, Texas and Louisiana.

The names given by the botanists of the 16th century would indicate that the plants came from Peru. It has no name in any of the ancient languages of the Orient, and there is record of its occurrence in Europe before the time of Columbus.

The tomato is in cultivation for a period of about 300 years in Mexico and other parts of the American continent. Two centuries ago there were no red or yellow tomatoes as we know them today and their improvement and evolution is really the accomplishment of the late 19th century.

It is sometimes naturalized in clearings near gardens but in the wild state no specimens of fruit such as are familiar to us in the cultivated state are found.

In Europe, China and Japan and the Malay archipelago, the tomato is in cultivation less than a hundred years.

The tomato, or love apple or Wolf peach belongs to the genus *Solanacea* to which the potato, tobacco, belladonna, henbane and Datura also belong.

WATERMELON

For a long time the origin of the watermelon was a mystery. Various observers attributed its habitat to Southern Asia or India because of its general cultivation in these regions but did not find it growing wild.

At length, Livingston, the explorer, found the watermelon in a wild state indigenous to tropical Africa on both sides of the equator where he saw large areas covered with the plants, particularly in the Sahara Desert. The fruit was eagerly devoured by the natives and wild animals.

The ancient Egyptians cultivated the watermelon and this fact is evident from pictographs on their monuments.

The Israelites were also familiar with the watermelon under the name *"abbatichim."*

The cultivation of the watermelon gradually spread over Asia and Southern Europe and the name appears in the language of these countries at a very early period or about the beginning of the Christian era. The modern Greek name is *"Carpousia,"* while the Turkish name is *"Karpus."*

From Europe the cultivation of the watermelon spread to America and as the melon is an annual, it ripens everywhere where the summer heat is sufficient.

The watermelon hybridizes with certain bitter species of *Citrullus* or bitter apple and sometimes a bitter watermelon results which cannot be distinguished from outward appearance.

CUCUMBER

The researches of De Candolle seem to establish the fact that the cucumber originated in Northwestern India at the foot of the Himalaya Mountains. The wild fruit is smooth, elliptical and has a bitter taste. This peculiarity is sometimes characteristic of the cultivated species.

The cucumber has been cultivated in India for more than three thousand years and in China since the second century B. C. Its cultivation spread more rapidly towards Europe and the names adopted show the antiquity of the cucumber in the various countries. The ancient Greek name is *"Sikuos"* or *"Sikua"* in the modern form.

(Continued on Page 55)

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Hunting Gars With Bow and Arrow

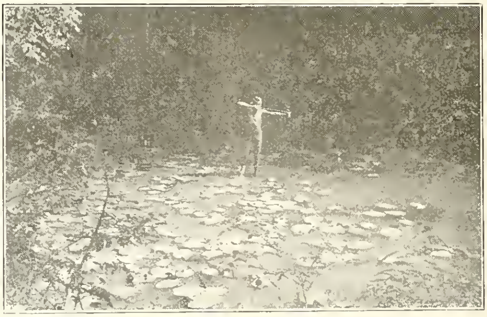
By B. F. LEEPER,
New Orleans, La.

(Editor's note: Mr. Leeper, an enthusiast in archery, photography and the out-of-doors, has kindly provided the following description of the sport of hunting the obnoxious Gar with bow and arrow. The scene of the particular hunt described is in Pearl River Swamp on Honey Island, Louisiana).

"ZING! Splash!" And into Valhalla, or elsewhere, enters the soul of another gar. Almost invariably, in my experience, the idea of shooting gars with bow and arrows is met with amusement and derision, but it is one of the most pleasant sports I have ever tried and, to me at least, there is something extremely satisfying, not to say thrilling, at each successful conquest with this primitive weapon—although the long-bow more properly should be described as medieval rather than primitive since its power and range of effectiveness is far greater than weapons of any aboriginal race of which I know.

In a description of the equipment I shall add an explanation for the uninitiated which, while possibly scientifically not entirely accurate, or complete, will at least serve the purpose for the practical sportsman interested in the game.

I have found a forty-pound bow (one requiring forty pounds to pull the length of its normal arrow, which is usually in proportion to the length of the bow, but may vary with different bow materials and designs) sufficiently heavy for this shooting, though this is only moderate target strength. An acquaintance, Mr. Earl B. Powell, well known in archery circles, used, if I recall the weight correctly, a one hundred and ten-pound bow for alligators in Florida. However, forty to fifty pounds is an easier shooting weapon with which I have never failed to drive an arrow completely through a gar when it was close to the surface and I hit it fairly on the side.



The archer, with tensely drawn bow, aims his deadly arrow at an unsuspecting Gar.
—Photograph by B. F. Leeper.

The arrows I found satisfactory are the regulation target arrows of Port Orford Cedar with parallel points—the so-called self arrows as contrasted to the footed arrows which have a section of heavy wood spliced on at the point, some of which are so heavy they will not float. It's a good trick to dip the feathers in dry-fly dope, though on well made shafts the feathers are attached with waterproof glue and a bit of wetting will do no serious harm.

Undoubtedly there is room here for the exercise of considerable ingenuity in the type of arrow head—the detachable head fastened with fishing line to the shaft, etc., but we usually go out dressed (or undressed as you prefer) to wade and swim for the arrows when necessary—and it usually is.

I have tried out a number of ways of using a reel with line attached to the arrow, but none worked out satisfactorily, though I still believe it should be possible if properly handled.

The parallel points have the advantage over sharp points, in that they do not have quite as great tendency to stick in submerged logs etc., which they may strike when they miss the gar.

The only additional equipment is an arm guard for your left wrist—supposedly unnecessary when shooting in proper form, but I know several reasonably good shots who almost always get their wrist slapped by the bow string—and finger guards or an old glove for the right hand fingers and a quiver for the arrows.

I will not attempt to go into the technique of archery. Many books have been written on the subject and an excellent treatise for the beginner is Phillip Rounsville's "Archery Simplified." Suffice it to say that there are certain fundamentals in handling the equipment properly that must be learned before any pleasure or skill may be expected, and the application of the practice from that time on will be a measure of the proficiency acquired.

The method of sighting, while theoretically similar, is practically considerably different from that of a firearm, and practice at unknown short ranges is essential to any hope for success. The minimum target range for men is forty yards, yet I cannot recall that I ever shot at a gar at that distance. Ten to twenty-five yards comes closer to be the usual range.

Now that our equipment is out of the way, let us go in search of our game.

My preference is for water slightly muddy or absolutely clear where there is a sandy, relatively shallow bottom. Under these conditions a gar may readily be seen swimming under the surface. In dark bayou waters where they are seen only when they break, my luck has been almost nil, because, though they seem to be most leisurely rolling along when they come up, you will be astonished, unless you have previously tried, at the almost impossibility of swinging a bow, or even a rifle for that matter, to cover and shoot them before they disappear.

RECOVERING A STRIKE.

Waist deep in the swamp, the archer seizes the arrow on which he has impaled a Gar.

—Photograph by B. F. Leeper.

So let us be fortunate and have a slightly muddy stream at hand. We walk along the bank, keeping as high above the water as possible.

"Watch him, Bill. See that dark shadow moving your way?"

"O. K., he'll be up in a minute, you cover him, too, in case I miss."

The cigar-like shadow darkens and in a few minutes the four-foot gar is covered by only a few inches of water.

"Zip!" "Splash!" And then more splashes indicate the second arrow is unnecessary. Bill getting the first shot by virtue of proximity and the last at this gar by virtue of accuracy.

"Nice shot, Bill" (I have to say something to cover my disappointment). "How deep is the water?"

"Don't rush me so—wait till I feel. Only about four feet."

Then we get our poles (picked up along the bank for the purpose) and begin probing for the corpus delicti.

As soon as he is located we try to work him in, one pole under him and the other hooked over until we can reach him.

If he is a small one and the water not too deep, we wade and try to kick him up with our feet (shoes on). We never try reaching for any gar until we can see it plainly — their vitality and the power of their jaws are enormous.

A surprising thing about gars is that when effectively shot with an arrow, although they often froth around on the surface for quite a few seconds, they usually sink straight down where they were hit, seldom, even in their struggles, getting over two or three feet from the spot where they were struck.

Usually in our hunting we each carry a .22 target pistol, because, if the gar is in deep water, a hit means a lost arrow. So we use the bullets instead of bows. Every now and then, however, it seems as if you just cannot resist the impulse to risk an arrow when some gar presents an unusually attractive if difficult target. If you miss, the arrow comes right back up and you can swim for it. In this game the penalties are on the hits. Not quite all, however, because there is a penalty of disappointment in the *misses* and a bonus of exultation on the *hits* that leave you willing to again chance losing an arrow when you know you cannot afford it.

The grass is green, the sky is blue,
Red roses bloom along the way,
But these would not quite have their hue,
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Scientific Management—Our Future Fisheries Job

By SETH GORDON
President, American Game Association*

We have all listened attentively to a long series of learned reports and discussions at this 63rd Annual Meeting of the American Fisheries Society. Many of them have been too "deep" for us laymen, but, like good students sitting at the feet of the mighty, we have been drinking them in. Whether we understand their full significance or not, in the end we know it will be good for us.

Now with your indulgence, I desire to present a few observations gleaned from my experience of twenty years in conservation work, which I hope may help all of us to focus our attention upon a few of the pressing problems ahead.

The members of this Society have labored diligently with fish cultural and research problems for sixty-three consecutive years. The federal governments, the states and provinces have accomplished much. Taken as a whole the progress recorded is of a most outstanding character. Those who have been responsible for this progress deserve our everlasting praise.

We Need An American Game-Fish Policy

What we need most right now is an American Game-Fish Policy, something akin to the American Game Policy, adopted in 1930. The same principles which apply to game apply to fish, but until we set up a policy by which to proceed we will continue to fumble and delay.

As in the case of game, we must get down to fundamentals. We must set up research objectives. We need stocking standards. We need stream and lake improvement standards. We need better coordination of efforts. We need more definite signboards by which to proceed.

In addition to what we can do to improve fishing in publicly-owned waters, and to extend such waters as rapidly as funds permit, we must endeavor to get landowners interested in improving the fish habitat on their lands. Then the old problem of the private fish pond, and the rights of the public at once arise.

How far should we go in acquiring fishing rights by lease and purchase as Connecticut has done? How far can we go in the improvement of fishing on privately-owned waters? And how far should we go toward encouraging private initiative in the production of fishing for the angler?

These are all matters upon which we can agree if we try, but we can't do it without an acceptable policy.

I hereby offer the cooperation of the American Game Association to this end. If this Society does not care to undertake such a task, I shall be glad to confer with the officers of the American Game Conference in the hope that they may see fit to put a committee, containing representatives from the Society, to work on a proposed draft for careful study before adoption, as was done in the case of the Game Policy.

Two Schools of Thought

There are those among us who hold that we have about exhausted the field of fisheries research, and that we have learned all there is to know about fish culture. They take the position that the old order of things must be changed; that all the scientists should be fired; that state and federal hatcheries should be closed, except for experimental work; and that the money saved should be used for stream and lake improvement to assure good angling, and plenty of fish for the nets of the fishermen.

Then there are those who hold that our knowledge, based upon scientific research, is after all very limited, and that the surface has merely been scratched; that we are just beginning to learn how to handle large mass production in our hatcheries and to ward off the many diseases and enemies which have beset fish culture far too long; and that we must grow more and larger fish at public expense to restock our waters.

But there is a much larger group in our midst which holds that no matter which of these schools of thought is right, the present supply of game, as well as food fishes, is entirely insufficient to meet the rapidly increasing demands, and that it is high time the scientists, the fish culturists, the administrators and the laity pool their interests for the common good.

Unfortunately there seem to be those, who sit in high places, too, who, noting these divisions of opinion among us, labor under the delusion that scientific research work is like the frosting on the cake, pretty to look at but not of much value, and that what we need is not more scientific knowledge but a more practical businesslike application of the information already in hand. This seems to be true especially of those charged with the responsibility for reducing governmental budgets.

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*Address delivered to the 63rd Annual Meeting of the American Fisheries Society, Columbus, Ohio, September 18-20, 1933.

Fisheries Trend Encouraging

Strange as it may seem, when big industries are up against it they redouble their laboratory efforts to ascertain why, and to find new and better ways to do things. When public agencies are face to face with enforced economy they put a match to the laboratory, fire the staff, and use the funds to build a bigger plant, hire more laborers, or to try some new experiments without a laboratory analysis. But that's the difference between business and government.

It takes years of consistent effort to build up a scientific staff that's worth a hoot, and only a few hours to destroy the morale and to upset the whole program.

Technically trained workers in public fisheries work are of comparatively recent origin, but they have so thoroughly demonstrated their usefulness that the trend in our public thinking is decidedly in their favor. This trend would be much more rapid if scientists would only remember to make their findings known in such simplicity that the general public could grasp the full significance of them.

Those interested in the success of our fisheries program, by and large, want facts. They are tired wasting time, a lot more money, and a lot more fish in rule-of-thumb experimentation. And instead of depending wholly upon our hatcheries to turn out enough fish to fill every creek, as so many of us have done in the past, the public is beginning to appreciate the proper relation between hatcheries and stream management. Many of them are going in for stream and lake improvement with a vengeance. But more of that later.

Kinship to Agriculture

Until we put our fisheries work on the same basis as agriculture we will get nowhere. Scientific agriculture and overproduction have about ruined the farmers, but I am not anticipating that the day will ever come when the streams and lakes will be so choked with fish that one must hide beind a tree to select the right fly. No one has yet glutted the market with choice angling, even though the commercial market gets glutted to the rotting point every once in a while due to lack of cooperative management.

Our fisheries work has lagged far behind agriculture, with its thousands of scientific workers, and its millions of dollars annually devoted to research and experimentation. Yet we all realize that the future of our fish supply depends solely upon the development of a program of scientific management of our waters, and the elimination of destructive factors and practices.

We have two fine examples of what can be done in the field of scientific research and fisheries management. Unfortunately for the 7,000,000 to 10,000,000 anglers in the United States and Canada, and naturally they are my first interest, these examples are in the commercial field, a field which has its strongly intrenched, well-organized groups to battle for the things they need to protect their interest.

I refer to the manner in which our two most important commercial fisheries, the salmon runs of Alaska and the oyster beds in the various parts of the country, have been stabilized and restored. In the case of the latter, it is said that more than 50 per cent of the annual harvest is taken from managed bottoms.

Pollution and Erosion

To the fields in which the U. S. Bureau of Fisheries has attained leadership—scientific research, experimental fish culture, Great Lakes fisheries management, and the salmon and oyster industries—should be added studies of other equally important problems.

Among these should be intensive study of the pollution and soil erosion problems, and their effect upon our fisheries, as well as upon the public health and recreational values involved.

We should learn how to use our water resources to better advantage through the development of extensive water farming, or aquiculture, as have the older nations of Europe.

Stream pollution is the most serious menace of all, yet nowhere in our present governmental setup in the United States is there an agency with power to act in inland waters. The U. S. Public Health Service is concerned principally with epidemics. The efforts of that same agency directed in the channels of preventive activities might well improve the general health level of our people who are compelled to take their water supplies from polluted waters.

The War Department is interested in pollution only when it affects navigation, whereas its staff of experts could well afford to aid in the elimination of a menace just as deadly as war.

The Bureau of Fisheries has no power to concern itself with pollution problems, but it spends many thousands of dollars annually to raise fish for stocking purposes.

States Alone Can't Stop Pollution

The new Industrial Recovery Act gives progressive municipalities a chance to clean house through the construction of sewage treatment plants. Uncle Sam is willing to pay 30 per cent of the cost of materials and labor, and to lend the

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other 70 per cent if the proposition is self-liquidating and presented in the right way. Hundreds of communities are planning to take advantage of this excellent opportunity, Oregon so far leading the Nation in that movement.

The various state departments are doing what they can to reduce the pollution menace, but they alone are helpless because many of the streams are interstate waters. Cooperative action has helped but something more is needed. This is a chemical engineering job for one of the federal agencies to head up.

If nothing more, the U. S. Bureau of Fisheries should at least be given funds to establish a central clearing house of information concerning the best methods for handling wastes of all kinds.

This information at present is too widely scattered, and a small staff in the Bureau of Fisheries devoted to this field would give the clean streams movement great impetus. Such an expenditure would produce far better results than ten times the same amount spent to raise more fish.

Stream and Lake Improvement

In addition to the need for coordinated effort to eliminate pollution, we must take full advantage of what we have learned about stream and lake improvement. And we must help to head off wild ideas that are doing far more harm than good, such as the stream improvement (?) job, done on a fine trout stream this past spring by an over-enthusiastic young leader of a camp in my home state of Pennsylvania.

Up to the present time most of our information on stream and lake improvement is confined to the state of Michigan, where Doctor Hubbs and his staff have been doing such a fine job, and to private sources.

It is clearly evident that sensible improvement programs will do more for many of our streams and lakes than will intensive stocking annually, except in the case of such heavily fished waters as the streams which the states of Connecticut and New Jersey are stocking weekly during the season to meet the demands of a dense fishing population.

I frankly believe that stream and lake improvement, properly done, holds greater possibilities than most of us now realize, and that this will be one of our water farming jobs of the future. Every state and province should give this phase of our fisheries work special attention.

Here again, however, is a work which should be headed up in the U. S. Bureau of Fisheries in order that all states and others interested may avail themselves of authentic information from a central source. Without such a central agency to guide and direct, much harm may be done by overzealous groups and individuals, and the movement will be retarded.

Refuges and Nursery Waters

Large numbers of refuges have been established for game birds and animals, but so far the refuge idea as applied to fish has not gotten very far.

Spawning and nursery waters are being set aside by certain states, and in some instances alternate sections of good fishing streams are closed to angling, but to date the studies to determine the value of such refuges and nursery waters have been inadequate.

Do they pay? Or do they not? Here is another field for intensive study by experts to determine whether this form of water management is wise.

This also is a line of study in which the U. S. Bureau of Fisheries should lead the way in making investigations, correlate the findings of the several states, and advise the public fully relative thereto.

Better Stocking Practices

In the past too many of our state and federal fish stocking programs have been 75 per cent "political pap" and 25 per cent good, old fashioned common sense. Why a state or province, or the federal government, should maintain fish hatcheries at large expense (all borne by the licensed anglers in the states) merely to supply friends, political or otherwise, with most of the fish is beyond me.

In making this assertion I am not unmindful of the excellent judgment and sportsmanship displayed by many of the recipients of such fish, but too many of our public-reared fish are going into private waters. No one can defend that practice. I firmly believe that half the number of good fish stocked intelligently, and where they benefit the public who pays for them, will produce twice as much sport for the disciples of Izaak Walton.

We are rapidly approaching the point where no public agency will stock fish until the waters have first been examined and approved by experts. And we are fast approaching the day also when all states, provinces and federal agencies will stock most of their fish with their own employes instead of shipping them to someone to help mend political fences.

Stream survey work, such as New York has been conducting so energetically, will put a stop to wasting fish, *if the recommendations of the experts are adhered to.* If not, then surveys are merely a waste of money.

Certain Hatchery Work Destructive

Certain phases of our hatchery work of the past have been most destructive. I have in mind particularly some of the hatchery operations intended to increase the commercial fish supply. On the Great Lakes, for example, the wholesale taking of fish during the spawning season has for years been justified on the flimsy excuse that it was necessary to spawn-taking for the public hatcheries devoted to commercial species, whereas if the operations of the fishermen had been regulated properly, and the fish they took during that period given a chance to reproduce naturally, the annual output would have been hundreds of times the number of fish released from the hatcheries—and the cost of the hatcheries would have been saved.

All of which is merely another way of saying that it is high time we stop wasting fish and pay more attention to the less spectacular, but immensely more profitable, job of regulating or managing our fisheries, whether they be commercial or sport, and give the fish in our waters a chance to produce a maximum annual increase under natural conditions.

Better Coordination Needed

Another phase of our common problem, especially from the standpoint of the angler, is better coordination of both state and federal stocking programs. No matter how carefully streams may be surveyed, no matter how much sensible stream and lake improvement work may be done, unless there is close coordination between federal and state agencies much waste and inefficiency, yes, even destructive work, will continue. There is no sense in deciding that a certain body of water should be stocked only with a certain species of fish, then to have some other agency stock a competitive species in the very same waters.

Much progress has been made in this direction, but there is still room for further improvement.

Curtailing Research Is Suicidal

Scientific management—water farming—is the big fisheries job of the future. We must transfer some of our former emphasis on hatchery activities to the management of our waters. By doing so we will get better results for less money, and "reduce the time between bites", as former President Hoover so aptly put it.

Notwithstanding our annual expenditure of about $5,000,000 in the United States for fish cultural work, we have failed miserably when it comes to developing a scientific research and management program which would assure the wise use of the fish so produced.

In recent years the U. S. Bureau of Fisheries has assumed a new leadership in the field of fisheries research. A staff of fine young scientists was being developed, until the staff was crippled recently in the name of enforced economy, largely because the very word "research" seemed to gall those who knew nothing about its value, and cared less.

If the present scientific personnel engaged in fisheries work is to be discharged or otherwise discouraged, the institutions of learning which have been turning out trained manpower for the fisheries field will urge their most promising young men and women to fit themselves for other fields. It must be made your business and my business to help avoid such a catastrophe.

To curtail our fisheries research, just well begun, is suicidal.

As I said in the beginning we need an American Game-Fish Policy, in which the importance of research and the various other suggestions contained in this address are each given their proper place. Then we will have a definite yardstick by which to proceed. Without it we will continue to waste time and money.

NOTE: The need for a Game-Fish Policy was endorsed by resolution by both the American Fisheries Society and by the International Association of Game, Fish and Conservation Commissioners. Both organizations pledged their cooperation to this end.

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Louisiana's Sulphur Mines

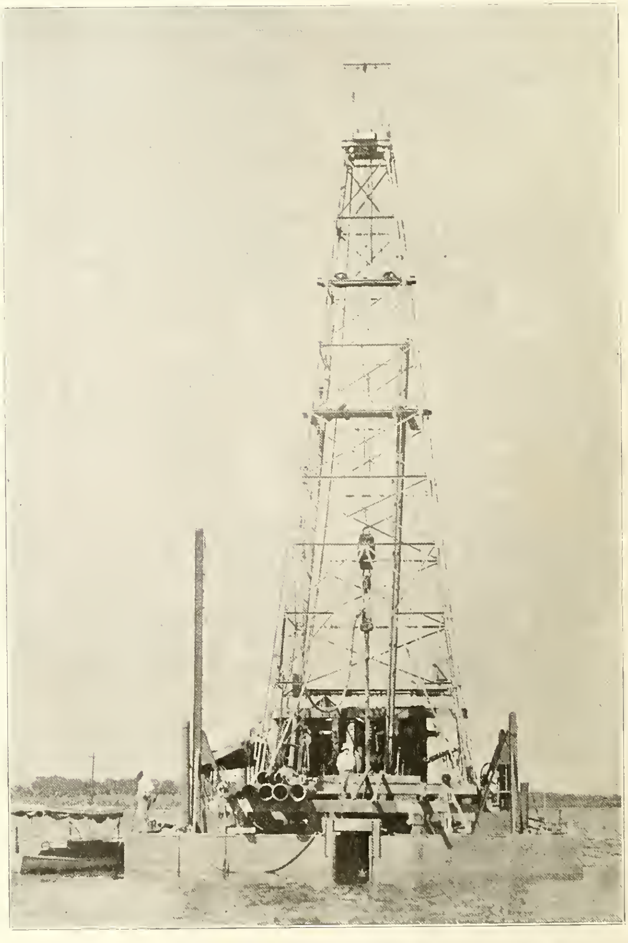
By

CYRIL K. MORESI, M. S.
Geologist, Department of Conservation

SULPHUR or Brimstone, as it is frequently called, has been known from the earliest times. Compounds of lead, antimony and arsenic with sulphur were used by the Egyptians as pigments and in the preparations of cosmetics. The use of sulphur in the manufacture of gunpowder was known to the Chinese many centuries before the Christian era, but it was not until 1200 A. D. that its use was introduced into Europe by the Arabs.[1]

Until the year 1905, when the mine at Sulphur, Louisiana, began production, 95 per cent of the world's supply of sulphur was mined and prepared for use in Sicily.[2] Since that time, however, a large proportion of the world's supply of sulphur and sulphuric acid has been produced from the by-product gases of smelters. At the present time the sulphur that occurs in the combined state accounts for about 65 per cent of the world's requirements. Free or elemental sulphur, which yields the remaining 35 per cent, is produced principally by the mines of the Texas-Louisiana Gulf Coast region. Free sulphur is also mined commercially in other countries, the most important producers being Italy and Japan, but their production is small compared to that produced in the Texas-Louisiana Gulf Coast region.

The sulphur produced in the Gulf Coast Region is mined exclusively from the cap-rock of salt domes. Not all salt domes have cap-rock, of those which do, only a few contain sulphur in commercial quantities. This report does not include a discussion of all of the South Louisiana domes having cap-rock, some of which have been explored for the sulphur content. The report deals with the history of the development and exploitation of sulphur on the Sulphur Dome, Calcasieu Parish, which was the first dome in the Gulf Coast region in which sulphur was mined commercially. In addition, it includes a description of the two Louisiana domes, Jefferson Island and Grande Ecaille, which are producing sulphur at the present time.



Floating Barge With Drilling Rig Used by the Jefferson Lake Oil Company.
—Courtesy Jefferson Lake Oil Co., Inc.

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[1] J. M. Rhodes, *Sulphur.*

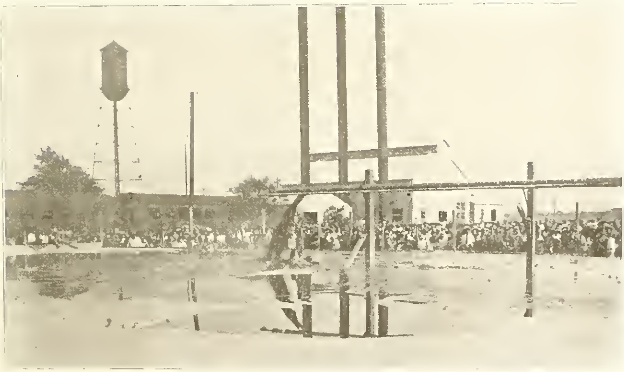
[2] *U. S. Bureau of Mines Information Circular* 6329, p. 5.

SULPHUR DOME
Calcasieu Parish

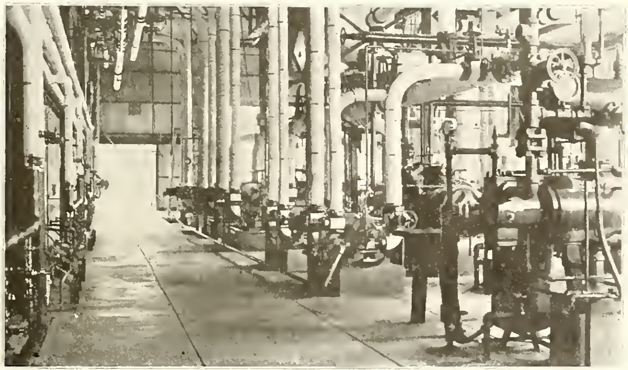
In 1865, the Louisiana Petroleum and Coal Company, while prospecting for oil, discovered sulphur at a depth of about 500 feet in Section 29, Township 9 South, Range 10 West, Calcasieu Parish. Years later this area was called the Sulphur Dome.

After the discovery of sulphur numerous efforts were made to mine the deposit and many companies, Austrian, French and American, failed in their efforts to obtain the coveted mineral. The American Sulphur Company having made many attempts to mine the sulphur, realized that it was impossible to sink a shaft because of the quicksand overlying the sulphur deposit. They secured advice from Herman Frasch, a chemical engineer of wide experience in the fields pertaining to the refined products of petroleum and salt. In 1893, the title to the land was acquired by the Union Sulphur Company. After some 12 years of experimentation and expenditure of a considerable amount of money and effort, Mr. Frasch succeeded in perfecting the process of mining which has made the Texas-Louisiana Gulf Coast the world's leading producer of elemental sulphur today. No history of the mining of sulphur in this region "can be complete unless it includes a tribute to the courage and perseverance of Herman Frasch, the father of the American elemental sulphur industry."[3]

Trestle Over Lake Peigneur, Supporting Steam, Water, Air, and Sulphur Pipes Between Power Plant and Sulphur Wells of the Jefferson Lake Oil Co., Inc.
—Courtesy, Jefferson Lake Oil Company, Inc.



Molten Sulphur Flowing Into the Vat—Jefferson Lake Oil Company's Mine.
—Courtesy Jefferson Lake Oil Company, Inc.



Interior View of Power Plant Showing Water and Steam Pumps of the Jefferson Lake Oil Company, Incorporated.
—Courtesy Jefferson Lake Oil Company, Inc.

The Frasch process, which is used in the mines of the Gulf Coast region, consists primarily in pumping water heated to about 350 degrees Fahrenheit into the cap-rock formation to melt the sulphur and an air lift which raises the liquid sulphur to the surface. The molten

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[3] Kelly, P. K., "The Sulphur Salt Dome," *Bull. Am. Assoc. Pet. Geol.*, Vol. 9, 1925, p 480.

Locomotive Crane Loading Sulphur at Jefferson Lake Oil Company's Plant.
—Courtesy Jefferson Lake Oil Company, Inc.

sulphur is conveyed from the wells to a relay station where it is pumped to a vat and allowed to cool and solidify.

In 1905, the property was placed on a commercially producing basis and for years this company held a monopoly of the sulphur market of the world.[4]

The Sulphur Dome produced sulphur for about twenty years. During this period a total of about 9,500,000 tons of sulphur was produced. The sulphur from the dome was exhausted in about 1924, and the Union Sulphur Company then began exploiting the dome for oil. At the present time this company is producing about 3,150 barrels of oil daily from this dome.

From 1924 until October, 1932. no sulphur was produced in Louisiana. However, sulphur was being produced from a number of the Coastal domes of Texas during this period.

JEFFERSON ISLAND DOME
(Lake Peigneur Sulphur Mine)
Iberia Parish

In December, 1928, the Jefferson Lake Oil Company began exploring for oil on the Jefferson Island salt dome, which is located in the parish of Iberia, about nine miles west-southwest of the city of New Iberia, in Township 12 South, Range 5 East.

The first well was located in the bed of Lake Peigneur, north of Jefferson Island. The well encountered limestone cap-rock at a depth of 650 feet and at a depth of 660 feet the bit picked up traces of sulphur. The percentage of sulphur increased with depth. Salt was encountered at a depth of 871 feet. The company then began to explore for sulphur.

After sulphur indications had been found in a number of wells drilled into the cap-rock, the Jefferson Lake Oil Company, in May, 1931, began the construction of a plant to produce the sulphur commercially.[5] The site of the plant is located on the northwestern side of Lake Peigneur in the parish of Vermilion.

On October 20, 1932, the first sulphur was obtained from the dome. The production has been continuous since that date. During the latter part of 1932, the mine produced a total of 13,401 long

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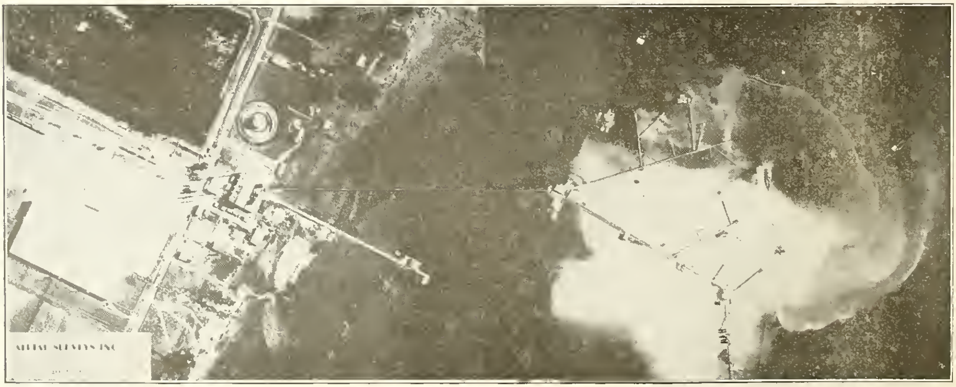
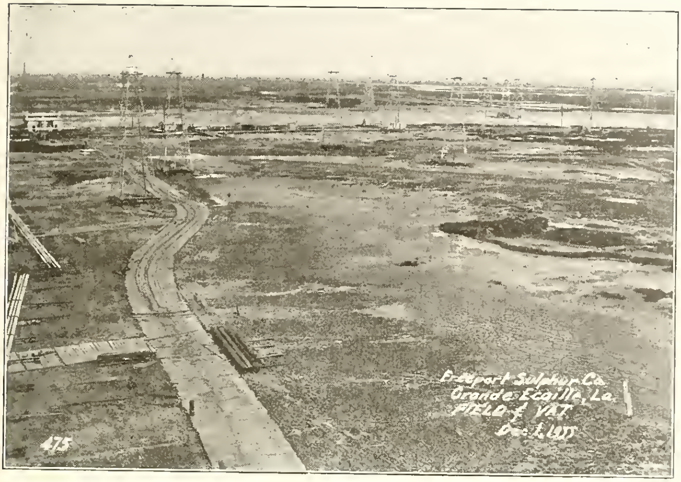
[4] *Ibid.*

[5] O'Donnell, L. O., "Mining Sulphur Under Water in Louisiana," *Chemical & Metallurgical Engineering*, Sept., 1933, p. 454.



Aerial Photograph, Showing the Jefferson Lake Oil Company's Sulphur Plant on the Left, and the Wells and Tram Walks Located in Lake Peigneur in the Right Half of the Photograph.
—Courtesy, Aerial Surveys, Inc., Cleveland, Ohio.



The Mining Area, Showing the Wells Located in the Producing Area. The Rigs Are Built on Hydraulically Made Fills.
—Courtesy, Freeport Sulphur Co.

tons of sulphur. In 1933, a total of 303,787 long tons of sulphur was produced. The sulphur is mined by the Frasch process.

The southern edge of the salt stock of the Jefferson Island dome possesses a remarkable salt "spine" which rises about 800 feet above the main portion of the salt stock. The main portion of the salt stock underlies Lake Peigneur. This "spine" is responsible for the mound known as Jefferson Island.[6] The Jefferson Island Salt Mining Company is operating a salt mine on the southeast portion of the salt dome and the Jefferson Lake Oil Company is producing sulphur from the sulphur deposit in the cap-rock, which underlies Lake Peigneur and overlies the main portion of the salt mass of the Jefferson Island salt dome.

The shape of the salt stock, as far as known, is elliptical. The top or upper surface of the main body of salt stock is rather flat and lies at a depth of about 900 feet below the surface of Lake Peigneur.[7] An irregular thickness of cap-rock averaging about 200 feet, overlies this portion of the salt stock. The uppermost portion of the cap-rock is composed of porous limestone with veins of calcite. Underlying this zone, traces of sulphur are present. The sulphur content increases downward to a depth of about 175 feet from the top of the cap-rock. At about this point the sulphur content decreases and the percentage of anhydrite increases. Anhydrite immediately overlies the salt.

Mr. Edward Laguerre, who was superintendent of the exploration work of the Jefferson Lake Oil Company, designed a complete drilling rig erected on a steel barge which was used in the exploration of the deposit and is in use at the present time. Approximately 75 wells have been drilled with this floating rig. At the present time a number of oil companies are using this type of floating rig for exploration in Coastal waters. Where explorations are located in tidal or rough waters, the barge is sunk to the bottom of the shallow lakes, bays or estuaries.

Freeport Sulphur Company's Power Plant and Shops at Grande Ecaille.
—Courtesy, Freeport Sulphur Co.

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[6] Howe, H. V., and Moresi, C. K., "Geology of Iberia Parish," *La. Dept. Consv.*, Geol. Bull. No. 1, p. 149.
[7] *Ibid.*

GRANDE ECAILLE DOME[8]
Plaquemines Parish

The Grande Ecaille salt dome, which is also referred to as the Lake Washington or the Cockrell Dome, is located about 45 miles south of the city of New Orleans in the southwestern portion of Plaquemines Parish, in Township 20 South, Range 26 East. This dome lies in the tidal marsh area of the Mississippi River delta, about ten miles from the right bank of the Mississippi River and within four miles of the Gulf of Mexico. The area is occupied by numerous lakes and bayous.

In the summer of 1929, the Humble Oil & Refining Company, which holds the mineral rights jointly with the Gulf Refining Company and the Shell Petroleum Corporation, began prospecting for oil on this dome. During the drilling operations for oil, sulphur water was encountered in the second well at a depth of about 1735 feet. In September, 1930, traces of sulphur were found in the third well in broken cap-rock formation at a depth of 1527 feet. Additional wells were drilled and indications were very favorable for the prospecting of sulphur.

In 1932, the Freeport Sulphur Company acquired the sulphur rights from the three oil companies and began to exploit this dome for sulphur. Drilling rigs erected on steel barges were used during the exploration of the sulphur deposit. A total of 30 sulphur wells have been drilled. Seventeen of these wells are located in the area which is producing sulphur at the present time. Commercial production of sulphur from the Grande Ecaille Dome began on December 7, 1933. The mine is producing an average of 900 tons of sulphur daily.

The salt stock appears to be roughly oval in outline, as far as determined, with a southeast-northwest diameter of about 3000 feet and the northeast-southwest diameter of about 4500 feet. The top of the salt lies at an average depth of 1500 feet. Overlying the salt is an irregular thickness of cap-rock, about 250 feet thick. The cap-rock consists of limestone, calcite, gypsum, celestite, anhydrite, sulphur, and traces of barite. The sediments overlying the cap-rock consist of clays, sands, and sandy clays.

The Humble Oil & Refining Company has six wells, located on the southwest portion of the dome, which are producing 700 barrels of oil daily. The production is obtained from a "broken cap-rock formation" lying at a depth of from 1127 feet to 1170 feet.

The problem of constructing and equipping a property with terrain conditions such as exist in this area lay in the selection and designing of foundations for the plant. The plan finally adopted consists of heavy reinforced concrete mats supported by piling for the foundations of the buildings and of hydraulically made fills for the vat foundations and mining area.

A site on the Mississippi River was selected as a base for receiving and handling materials. This locality is known as Grandeport. To provide more rapid and economical transportation from the mine at Grande Ecaille to Grandeport, a canal approximately 100 feet wide, nine feet deep, and ten miles long, was dredged, involving the movement of some two million cubic yards of dirt.

Since the mining of sulphur involves the handling of large quantities of water and as all lake and bayou water in this area is high in salt content, it became necessary to obtain the water from the Mississippi River. A fifty million gallon earthen reservoir was constructed for settling the turbid water from this stream and a pipe line approximately nine miles long conveys the water to the plant.

The waste water from the mine is conveyed to a treating unit located 1000 feet from the power plant where the objectionable sulphide impurities are to be removed before disposal.

The Frasch process is used for the mining of the sulphur. The solidified sulphur is blasted, loaded on a belt conveyor and discharged into barges for transportation. At Grandeport the sulphur is unloaded from the barge and carried to the holds of vessels at the docks on the Mississippi River.

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[8] The author wishes especially to thank Mr. J. M. Rhodes, Freeport Sulphur Company, for the information supplied concerning the exploration of this dome.

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The Civilian Conservation Corps

By V. H. Sonderegger

Director Forestry Division Louisiana Department of Conservation

THE "Civilian Conservation Corps" provides employment for nearly three hundred thousand men in the forests throughout the United States.

The purpose of President Roosevelt's plan was to give employment to the eighteen to twenty-five year old boys of the nation whose families were destitute. The president, who is a keen student and a strong advocate of forestry, concluded that the best way to employ these boys would be to place them in the forests of the nation. In this manner, the young men receive remuneration for their services, are able to build up physical strength, and, at the same time, return to the nation results in the protection and development of the forests which have been badly needed, and, which in the past, have not been properly undertaken due to the lack of funds.

Louisiana received an allotment of twenty-three camps. All of the camps have been manned by Louisiana men. In addition to the enlistment of the eighteen to twenty-five year old boys, three hundred men twenty-five years of age and over and who had experience in woods work, were added to the camps. These men were classified as experienced woodsmen and were inducted into the various camps to act as leaders for the eighteen to twenty-five year old boys in the forests.

In addition to the twenty-three camps, Louisiana was allotted four additional camps for the winter season. The four camps were transferred from the West due to extreme winter conditions. Of the four additional winter camps two were assigned to the United States Forest Service, and two to State Park work under the supervision of A. P. Daspit, Director of the Wild Life Division of the Department of Conservation.

Four camps are assigned to the State Board of Engineers, under the supervision of Mr. Harry Jacobs, State Engineer, and are used primarily for the construction of roads along the levees on the land side. Louisiana's levees, during the high water and dangerous periods, are not accessible for emergencies, and the four camps assigned to Mr. Jacobs, upon his request, are for the purpose of building roads along the levees and connecting such roads with the main line highways, as well as railroads, so that during the emergencies, these levees can be reached rapidly with labor and material. These four levee camps are the only four of the kind of all of the conservation camps created, and this work is being watched with a great deal of interest by engineers and others who are interested in flood control and flood protection.

Sixteen of the camps are detailed to forestry work, of which fourteen are located on private-owned lands and two on state-owned and state-controlled lands. The latter two camps are located on the state forest near Alexandria, La., and on the Allen Northwest Game Refuge near Winnfield, La.

All twenty-seven camps in Louisiana are established and producing efficient results in the projects allotted to them. The work of selecting the men, selecting camp sites, and selecting the personnel, as well as tools and material with which the men work, has been a huge task. In Louisiana it has necessitated the working of all agencies connected with the forestry work every day of

Building Dirt Roads in Cut-over Forest Areas Making Them Accessible to Fire Fighters.

the week with a disregard of time. The result has been that all twenty-seven camps have been established and equipped so that they function 100% and the work is progressing rapidly and efficiently.

The Civilian Conservation Corps' enrolled men receive $30.00 per month, with their board and clothes furnished. In addition, they receive medical aid, as well as hospital service, and are included under compensation for any injuries that may result. There is no military training involved and all men have been trained to improve their physical condition to undertake the work. Eight hours a day for five days a week, or a total of forty hours a week, are the requirements for labor. The balance of the time is spent in recreation, or in reading, studying and athletics, or leave of absence, as the enrolled men may see fit, subject to the approval of the army captain in charge.

The young men who are enlisted in these camps are assigning a sum of $25.00 per month to their parents or other dependents, the balance of the money being used for personal needs.

After a short period—not quite six months—the writer has observed a remarkable change in many of the conditions existing. A great many of the boys were destitute and out of employment. Since their enrollment, these young men have gained in weight and are given healthy work which has been the means of building up their physical condition. In addition, their mental attitude has changed completely. In place of discouragement and indifference, the general aspect of the young men throughout the state is full of hope and ambition. Irrespective of the work that has been obtained, I believe that the greatest benefit possible has been given to the young men of Louisiana, as well as other states, through their employment in the forests of the nation.

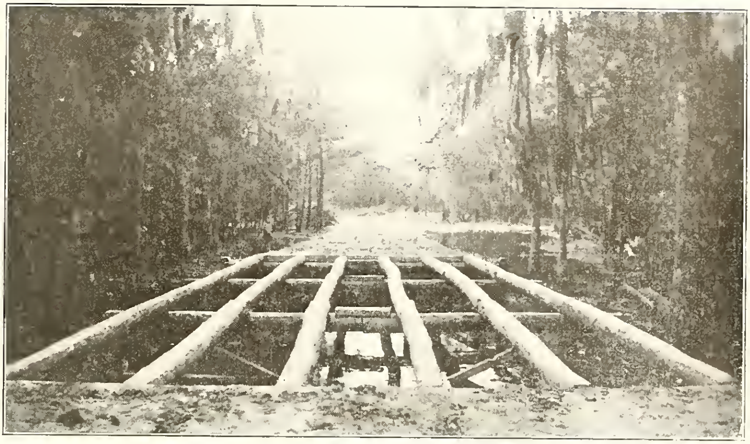
A great deal of uncertainty exists as to just what the reforestation program constitutes as employed by the Civilian Conservation Corps. In the camps on the national forests, all phases of reforestation are practiced. In Louisiana, the national forests constitute a large acreage of cutover lands without any tree growth. These areas must be planted with young trees. Similar activities have been carried on on other holdings in the state, and particularly in line with the program which the Great Southern Lumber Company has practiced, whereby it planted over thirty million trees on thirty thousand acres. On the state forest camp, a small acreage—not over four hundred acres—will be planted. Otherwise, no other tree planting programs will be carried on in the state.

On the Federal and State owned lands, forestry methods such as tree planting, thinnings, and experimental work can be carried on. On the fourteen camps located on the private lands, no tree planting is permitted. The work consists entirely of forest fire protection improvements as follows:

Construction of truck trails throughout the forested areas, thereby permitting the State's permanent forestry organization to fight forest fires rapidly and efficiently. Secondary truck trails are built off the main truck trails, making all areas available for fire fighting, and along the public highways forest fire hazard reduction is permitted. Forest fire hazard reduction constitutes the removal of hazardous material along the roadsides and other material which might permit fires to start from carelessness. To facilitate fire fighting, fire lanes are created around the sections at intervals of one mile or a half mile. Such fire lanes are built for the purpose of fighting and controlling fires and restricting them to small areas instead of burning over conditions that existed in the past.

Telephone lines are are being constructed throughout the for-

Hot Lunch Served at Noon in the Woods. Veterans Camp, Slidell, La.



A portion of the Great Southern Lumber Company's 30,000 acre hand-planted forest 1,000 to the acre and 9 years old. A combination road and fire line constructed to protect these trees from fire.

ested areas so that the forestry employees may be called immediately for fire fighting. In addition, new one-hundred-foot steel towers are being erected to facilitate forest fire detection. This work was not possible in the past, due to the lack of funds.

The greatest problem in reforestation is prevention and control of forest fire and the only satisfactory way to overcome forest fires is to establish a system of roads, fire lanes and telephone communication. It has been impossible for the State of Louisiana to adequately handle this work in the past, due to lack of funds. However, with President Roosevelt's program now established and these funds allotted to Louisiana, at the end of the period of the Civilian Conservation Corps projects, we will have an ideal protected forest area and the reduction of forest fires will be accomplished, thereby permitting a vast acreage of lands in the State of Louisiana to reforest naturally and produce forest products in a short time, due to the rapidity of growth in this area.

In accordance with the instructions of the United States Forest Service, the Civilian Conservation Corps may do this work only on such forest lands as participate in the Clarke-McNary Federal allotment. The lands in Louisiana benefiting by the Civilian Conservation Corps work are all reforestation contract lands and all lands under the protection unit work of the State. The protection unit work lands are those on which the landowner is paying to the Division of Forestry 2 cents per acre per year for fire protection. The State and Federal Governments meet the balance of the expense and protect the lands from year to year.

As previously stated, the State of Louisiana materially benefits by the work being done, as the timber resources of Louisiana have been its biggest asset in the past and are one of its potential assets for the future, and all work and money expended for this effort will produce large returns not only in the new timber crop, but in the manufacturing interests which convert the timber into the finished products.

With reference to the rehabilitation of our young men in this State, the work has materially benefited the youths who have enlisted. Not only

(Continued on Page 55)

Camp Davis, Ansley, La. Civilian Conservation Corps.

Louisiana Nature Guardians

"Upon my honor, as a Louisiana Nature Guardian, I promise to take care of all our natural friends, to guard and protect them to the best of my ability, and as far as possible influence others to do the same."

HOW YOU CAN BECOME A NATURE GUARDIAN

YOUR PART

Consult your teacher.

Ask that the purpose and plans of the Nature Guardian Club be explained to you and the class.

Ask for an application card.

Get a responsible person to indorse it, after proving that you fully understand the duties of a Nature Guardian.

Sign the application and mail the card postpaid, or give to your teacher, to send with cards from all the class.

OUR PART

We send the application card.

We send you a handsome badge, a certificate of membership, Nature Guardian pamphlets, and other literature.

This is all free, and is carried on with the purpose of instilling in the children's minds a knowledge of Louisiana's wild life and a thorough understanding of its economic value to the State.

It also aims to develop individual humanitarianism. Even within this short time an amazing improvement has been made in the mental attitude of our young folks toward the conservation and protection of Louisiana's natural resources.

EDITORIAL

MY DEAR GUARDIANS:

After the holiday season is over a sort of "let down" feeling seems to take possession of everybody. This is just the time to find something new and interesting to do. How about setting out some of Louisiana's beautiful wild trees and shrubs?

Gardeners tell us to transplant specimens to the home or school yard while the "sap is down." If you will consult your Senior Guardian perhaps he or she will be able to help you select just the plants best suited for your plot, and show you how to dig them up, and how to transplant them so that they will have a good chance to grow. There is a certain way to do this that almost guarantees their living and thriving.

If there is a forestry worker near you, by all means consult him. He will be delighted to help you.

Because of our very warm autumn season, it should be easy to find suitable objects to add to the Nature Guardian Museum which we hope has been started in every school in the State. It is remarkable how such a collection grows, and how many curious and interesting specimens find their way to its shelves.

Among the things that are easily collected are different varieties of wood, with bark, fruit, and leaf; shells, soils and oils; birds' nests and eggs, (if lawfully obtained); pressed wild flowers; animal pelts; and pictures of birds, fish, animals, etc.

Some clever high school artist could make posters showing different sorts of bird claws or of birds' beaks. Perhaps another artist could draw and color a large brown pelican—our State bird—to add to the collection.

There are endless possibilities in such a museum, and the average Guardian would be delighted to see something of his own collecting in the group, and to have his name among those working for its success.

Don't you want to start such a muesum in YOUR schools at once, Guardians? All it takes is just a little effort on your part to awaken interest in a teacher, a Senior Guardian, or in a group of your fellow students!

With best wishes for a bright and happy New Year,

Faithfully yours,
NATURE GUARDIAN EDITOR.

Dexter, Mo., Nov. 4th, 1933.
R. F. D. No. 3.

Dear Editor:

We would like to become members of the Nature Guardian Club, although we live here in Missouri. If we may join, please send an application blank each.

We have always wanted to join a club of this kind, as we are interested in Nature. We have lived in the Ozarks mountains where there are all kinds of wild flowers and birds. There were always forest fires in the spring which we always helped to put out, and we always protected the birds.

We will do all that we can to promote your Club.

Respectfully,
RAYMOND R. FELIX, JR.
JAMES C. FELIX,
Dexter, Missouri.

We sent Raymond and James their application cards, and we were happy to make them honorary members of the Club. They are happy, too. Just read what they say about it:

Dexter, Mo., Nov. 24th, 1933.

Dear Editor:

We have just received our badges and certificates of membership. We are surely proud of them. We are certainly proud to become members of a Club of this kind. We like to protect our forests and wild life, and are sure others would like to become members.

Sincerely yours,
Raymond R. Felix,
James C. Felix.

Colfax, La.

Dear Editor:

I guess you think that I have forgotten my Club, my duty, and everything—but I haven't! I am sending you a little poem that I hope you will like and publish in our Nature Guardian Corner.

A true Guardian,
Evelyn Denton.

The poem is very pretty, Evelyn, and we are glad to print it.

The Rose and the Gardener.

The rose in the garden slipped her bud,
And laughed in the pride of her youthful blood.
As she thought of the gardener standing by,
"He is old, so old—and he soon must die."

The full rose waxed in the warm June air,
And she spread and spread till her heart lay bare,
And she laughed again as she heard his tread,
"He is older now and will soon be dead."

But the breeze of the morning blew, and found
The leaves of the blown rose on the ground.
And he came at noon, that gardener old,
And raked them softly under the mold,
And wove this thing in a random rhyme—
"The rose is Beauty, the gardener, Time."

Mansura, La.

Dear Editor:

While reading July's Conservation Review, I came upon a letter, which I sent you several months before. I was very happy to have my letter in print. I would love to become a member of your most interesting Club.

I have been residing in Mansura, La. for the past six months. It is a very small town, but there are many interesting places such as, Grand Ecore, Lake Pearl, Fish Bayou, Red River, etc.

I love the country with its never ending fields of cotton and corn, the sweet scent of the clean fresh soil, the pretty woods, swamps, etc.

The young set here are forever giving picnics, and parties in the woods. I love to hear the hooting of the owls, the echo of our voices, and see the light of our bonfire (although we are very careful to see that it is thoroughly out).

There is a pretty place to go swimming, fishing and boating, which I do frequently.

I am a very good horse back rider, and may more often than not, be seen on a horse. I love horses.

As you must be tired reading this letter, I will make quick exit. I promise to be a faithful, loyal Guardian.

I would love to know all the Guardians, and to be one of them. I will be anxiously awaiting to hear from you. I expect to leave Mansura within three weeks. If you do not answer within that time, do not address it here. You may write in care of 1109 Royal Street, New Orleans, La.

With oceans of love,

Always yours,
(Miss) Rita Lee Scallan,
Mansura, La

Always remember and don't forget
There's a girl waiting to hear from you yet.

We are glad to hear from Rita again and have sent her the material for which she asked.

A LAKE

By Edurna Chagnard

A lake is a place of solitude
Where one may rest so free.
A place so quiet and restful
Where all would like to be.

Out on the water, smooth and fresh,
Gliding in a canoe,
Through the blue green water,
As the sunset fades from view.

Welcome, Edurna! We are delighted to have a new poet among our ranks. Write to us often and tell us how you like our Club.

LOUISIANA SCENERY

By Dorothy Standley

Travelers in Louisiana are charmed by the water-lily ponds covered with flowers—stately things of purple, white, and yellow. The colors are clear and bright as an opal in which the mingling nuances are each emphasized. These lilies are also cultivated in private gardens and in parks but always they form a part of natural scenery—even in ditches along highways they enrich the landscape.

Louisiana woods flourish. Driving is a pleasure for both the native and the tourist because of the natural beauty provided by the trees. The woods furnish excellent and picturesque picinic and camping grounds.

A scene which is poetry-material is a long driveway which is lined by massive oak, cedar, magnolia, or pecan trees which are like dignified, friendly sentinels. The loveliest and rarest of these driveways is formed by the magnolia; the large spicy-scented white blossoms are as fascinating and exquisite as the pre-civil war beauties whose descendants still care for the surrounding gardens.

The gardens are more often informal than formal. Beds of quaint old-fashioned flowers—jasmine, Sweet Willam, lady slipper, cape jasmine, larkspur, and myriads of others—add charm to the stately, white-columned homes. The little summer-houses situated in gardens are intricately latticed. No doubt many a proposal has been made in one of these fairy-like nooks—it is part of a stage setting for romance. The only things similar to these romantic little places are the ones the Louis's of France had built in the gardens of Versailles.

Louisiana should not be mentioned without a vision of the picturesque French or Spanish quarters of every old city in the state. Antique houses fronting directly on sidewalks have balconies of delicate iron grill work which enchant the tourist. Typical of these old houses is the courtyard which is a delight to the sight-seer as well as to the owner. In the courts informal visits are paid because the fountain in the center, the profusion of flowers and urns, make it a cool, inviting spot.

People visit Niagara Falls for grandeur, Yellow Stone Park for magnificence, but New Orleans for Mardi Gras gaiety. This favorite southern city becomes at Carnival time the naughty, riotous little sister of Paris because the crowds are similar to those celebrating July Fourteenth in the latter city. The gorgeous carnival floats, the fantastic costumes of the motley crowd draw hundreds of people to celebrate for the last time before Lent.

Besides its attractions made by the art of man, Louisiana is utterly unique and different from

(Continued on Page 55)

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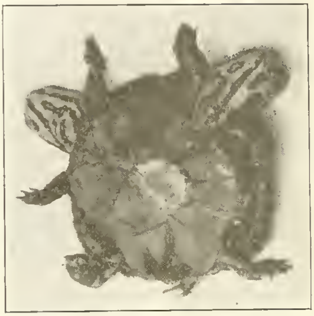
TWO-HEADED TURTLE A REMARKABLE PET



Pbotograph of six-legged turtle viewed from beneath. The observer will note the excellent development of botb beads of this extraordinary one-tailed, one-shelled, six-legged creature.

Dr. M. Forwalter of Van Wert, Ohio, has provided the Conservation Review with an interesting photograph of a two-headed, six-legged living turtle which came into his possession in December, 1932. Discovered on the bank of a small stream in Texas by a quite sober tourist from Michigan, this turtle was found to display at times perfect coordination between all six of its legs. However, at other times disorganized movements were characteristic of the animal, greatly interfering with its locomotion.

Both of the heads of this strange turtle took food, but an ex-ray revealed the presence of only a single stomach.

Dr. Forwalter kept this remarkable animal as a pet for six months during which time it fed well and continued to grow. So attached indeed did he become to it that he declined to sell it to Robert Ripley of "Believe It or Not" fame. When, however, at the end of six months the turtle languished and died, its remains were disposed of to Ripley and placed on display in the "Believe It or Not" Odditorium at the World's Fair in Chicago.

Such partially double animals are by no means remarkably rare but few appear to survive, since under the conditions of nature they are so often less well equipped to survive in their surroundings. Really partial twins, such double-headed animals are strictly comparable with the famous human Siamese Twins and are invariably of the same sex. They present, in fact, the partial development of two still attached animals from a single egg. The amusing names given to this turtle by Dr. Forwalter, Maggie and Jiggs, were therefore though distinctive, biologically misleading.

THE CIVILIAN CONSERVATION CORPS

(Continued from Page 51)

have they developed physically, but they have been taught the elements of forestry. Their work has assisted not only themselves but also their dependent relatives, and Louisiana will benefit materially from the co-operative effort of this vast army of the Civilian Conservation Corps.

CROP PLANTS OF LOUISIANA

(Continued from Page 37)

The Latin name is *"Cucumis,"* in Bohemian *"Agurka"*; in German, *"Gurke"*; in Armenian, *"Karan"* and in Arabic, *"Chiar."* No trace of the presence of the cucumber has been found in ancient Egypt.

The West India gherkin so commonly classified with the cucumber, originated from a different species of *cucumis*. There is also a "snake cucumber" which is botanically distinct from the common everyday cucumber.

The cucumber was evidently introduced into Louisiana from France or Spain in early times.

RADISH

The radish has been in cultivation for over 2000 years and is mentioned by Theophrastus in his writings. Its habitat appears to be Western Asia and south of the Caucasus where it is found in an apparently wild state.

Linnaeus supposed that the plants cultivated by the Chinese were of Chinese origin, as the species spread easily from cultivation there. Other botanists have also taken this stand.

The builders of the pyramid Cheops, as stated by Herodotus, were consumers of radishes and inscriptions on the temple of Karnak appear to have reference to the radish as an article of food of the ancient Egyptians.

There is no doubt but that in the earliest historic times the radish was cultivated in the gardens of all the temperate regions of the old world, as it is now in every cool section of the globe.

It probably came from Europe and was planted here by the early colonists. There are no records to guide us.

LOUISIANA NATURE GUARDIANS

(Continued from Page 54)

any other State in its natural scenery, in the great variety of landscapes so unusually colorful.

Among the teachers who have formed Nature Guardian Clubs in their classes this fall are the following:

Miss Callie Walker, Eros, La.
Royal Brown, Meaux, La.
Mrs. Willie Brown, Kilbourne, La.
Mr. W. J. Austin, Elton, La.
Mrs. May Grounds Young, Minden, La.
Miss Maude Windsor, Converse, La.

We extend a hearty welcome to all of our new members, and hope they will become happy, useful, and faithful Guardians.

We shall be glad to hear from our members at any time, and shall be glad to print their poems, themes, and letters about any of the natural resources of Louisiana. We hope that our next issue will contain many interesting articles by members of our Club.

Address all letters to: NATURE GUARDIAN EDITOR, DEPARTMENT OF CONSERVATION, New Court Building, New Orleans, La.

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30,000 AMERICAN ACRES PLANTED IN TUNG OIL

Washington, D. C., Dec. 10.—Before many years have passed American manufacturers may be independent of the monopoly which China has long held in the tung oil industry. About 30,000 acres of tung trees now are thriving in our Southern states. Some experts aver that it would take only slightly more than three times as many acres of producing trees to make America independent of the Oriental product.

"Tung oil, some times called Chinese wood oil, is extracted from the seeds of the tung tree of Central and Western China. It is almost unknown in its natural state to the average layman, but, being a good mixer, it hides in many products with which he frequently comes in contact," says a bulletin from the Washington, D. C. headquarters of the National Geographic Society.

"Long before western shipping navigated the Yangtze river, Chinese river men waterproofed their boat timbers regularly by saturating them with tung oil. They also burned the oil in lamps, accumulated tung oil soot to make India ink, and with carbon from burned seed pulp and other materials made a calking compound.

"Although tung oil-soaked junks frequently side-swiped western craft in Oriental harbors and rivers, it was not until about 1869 that westerners awoke to the fact that tung oil had some amazing qualities. Chemical laboratories discovered that the oil, added to varnish, makes the varnish shed water like a duck's back; thus the origin of the demonstrator in the hardware store window who awes shoppers when he pours hot water on a table top without marring the polish.

"From the Chinese success in waterproofing silk with tung oil, westerners learned that other fabrics could be rendered waterproof in much the same manner. Now tung oil is widely used by manufacturers of raincoats, bath curtains and oil cloth. Wall board manufacturers have discovered that the oil makes a good binder; while the manufacturers of linoleum, steam pipe gaskets, wire insulation, and automobile enamels, also have become customers of Chinese tung oil producers.

"The United States normally imports about 90,000,000 pounds, or more than $10,000,000 worth of tung oil annually. China's internal unrest has been one of the leading factors in the development of American tung tree plantations. When the value of the oil was discovered, the demand of the American manufacturer grew rapidly. Normally he could obtain sufficient tung oil, but brigands often delayed or destroyed shipments. or producers were deserted by their workers who now and then felt the urge to fight, thus diminishing the supply.

"The first tung seeds from China were planted in the United States by the department of agriculture in 1905 at Chico, Cal. A year later, the resulting seedlings were sent to experimental stations through the Southern and Pacific coast regions. They thrived in portions of Florida, California, Alabama, Louisiana and Mississippi where the frost is not sufficiently severe to nip the trees' sensitive blossoms.

"Tung trees grow to about 25 feet in height. With their white to pinkish blossoms in the spring they resemble apple trees.

"The tung fruit is about the size of a small apple. Its five seeds are no longer than robbins' eggs. In China the trees grow wild, but in this country growers have operated their plantations with the modern system of an American orchardist. When the tung fruit ripens in the fall, it drops to the ground. In China the hulls are stripped from the seeds by hand, in this country hulling is done by machinery. Gainesville, Fla., has a tung oil pressing plant.

"America's new tung oil plantations are near railroads and modern highways—quite different from the forests where tung trees thrive in China, for there are neither roads nor railroads. To reach the Chinese trees one must penetrate the remote mountain valleys of Hunan and Szechwan provinces.

"The oil is carried on human backs to the nearest river shipping point in light bamboo baskets lined with 16 thicknesses of waterproofed paper. Before it reaches the sea, most tung oil shoots the rapids of the Yangtze Gorges. It is not uncommon for junks containing the oil to pile on the rocks, thus releasing an $8000 cargo into the swirling stream."—N. O. Times-Picayune.

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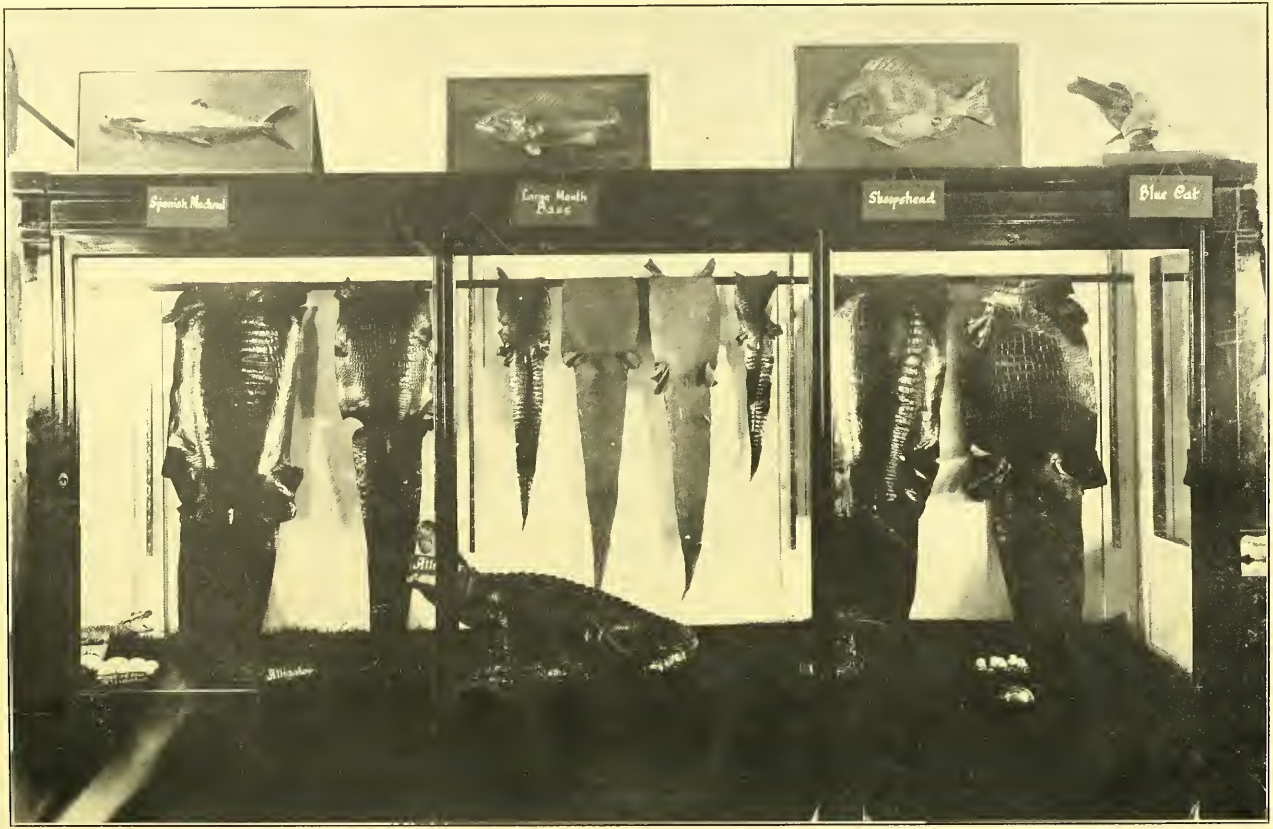

Exhibit of Louisiana Alligator Skins which Supply the markets of the World—Conservation Museum, New Orleans

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